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Index to Advertisers—Page xl.

Principal Contents:

	PAGE
Heavy-duty Pumping Installations	267
Installing Water Heaters. By Philip Honey	269
A Tariff Line Chart. By R. W. Wilson	270
Public Television Commences	271
Nickel-alloy Magnets. By A. B. Everest	273
Faults in Motor Drives. By C. H. Smith	274
Motors for Steel Works. By "Engineer"	275
Operation Results at St. Denis. By S. H. Kahn	275
The Mercury-jet Wave. By W. E. French	276
Correspondence: Fatalities in the Home; Earth-leakage Switches in Melbourne; Penalising the Industrial User; The Meters Act	278
New Apparatus and Devices	280
The 1936-37 Lamp Publicity	281
Business and Industrial Notes	283
Electricity Supply	286
Traction and Communications	288
Contract Information	289
Notes	290
Our Personal Column	291
The Industrial Situation in Japan	292
Financial Section	292
Published Specifications	295
New Work for Contractors	296

Why Wait for Legislation?

DISSATISFACTION with the present state of distribution is due largely to the body of technique having burst the strait waistcoat in which it was confined by the early supply Acts. At one time the d.c. systems laid down for lighting may not have been unduly cramped by being limited to local government areas, but the coming of the steam turbine, the transformer and the three-phase induction motor destroyed the old simplicity of things.

In earlier years the existence of a multiplicity of undertakings with individual views was not perhaps an unmitigated evil, as it afforded opportunity for diverse engineering methods to be thoroughly tried in practice so that the best could be selected for survival. The belief that full use had not been made of this opportunity to benefit by natural selection was one of the reasons for the McGowan Report, with its compulsory speeding-up proposals.

The worst of impending legislation is that it often holds up those developments that it is calculated to foster. But is there any reason why it should do so in the present case? In so far as the recommendations are in line with the general opinion of the supply industry, some steps can surely be taken to anticipate their requirements without straining unduly the present statutory swaddling clothes. Why wait, for instance, for the appointment of District Commissioners before setting up advisory committees in suitable areas?

How far is it practicable by agreement to minimise the effect of arbitrary boundaries in limiting development—in deciding, as an example, from which authority's distribution centre high-voltage feeders should be run to supply overloaded or new sections of a low-voltage network? How far can the most be made of geographical position by linking up such networks, with a view to economising copper and reducing voltage drop, even though they belong to separate undertakings? Could not stocks of transformers in standard sizes and with standard windings be drawn upon by more than one undertaking as spares for single-transformer sub-stations?

Voltage standardisation is likely to be forced upon the industry by the public, sooner or later, if it is not carried out for technical reasons. The 237 near-standard undertakings, however, may well take advantage of the increased tolerance in voltage variation permitted to declare 230 V at their consumers' terminals; the great majority of other voltages are now below 230, so that the cost of the change would be offset to some extent by an increase in the carrying capacity of the mains. There is, too, the question of speeding up the change-over from d.c. to a.c,, which involves, where bulk supplies are received, a consideration of the value of the losses avoided in conversion.

Over half the costs of distribution are capital charges, of which cables account for the greater proportion. There is no doubt that the expenditure on cables could be considerably reduced if there were not, as the McGowan Report stated, a tendency for each undertaking to require small variations in design. This seems the less defensible on account of the existence of British Standard Specifications, which presumably represent a consensus of experience on the subject. Mr. L. Romero suggested in our columns of June 7th last year that two standard cables of 0.25 and 0.125 sq. in. copper would serve all needs. Why not?

While such activities would leave untouched the question of increased output, which provides the main avenue for improvement in distribution, they would, nevertheless, help to construct a sounder engineering framework on which to base load building for many years ahead at the accelerating rate that the public requires.

Television

DEMONSTRATIONS of television reception at the Radio Show, Olympia, which opened on Wednesday, are showing that manufacturers on their side have commenced to take advantage of the facilities provided by the B.B.C., which has indicated, by the "battleship" standard of installation work at Alexandra Palace, its faith in the future of the new form of broadcasting. The high definition and, generally speaking, the good quality of the pictures received over a distance of something like ten miles bear witness to the progress that has been made recently. No doubt "technical hitches" are to be expected for a while, as in the early days of sound broadcasting, and the effects of interference, due to other electrical users, are often noticeable; but such difficulties are minor ones compared with those that have been so successfully overcome with the aid of recent developments in associated electrical fields.

The Fall of the Year

A REMINDER that the autumn approaches has reached us in the programme for the first half of the winter session of the now venerable Junior Institution of Engineers. The opening meeting will be held on October 2nd, when there will be informal discussions, one of which will relate to the possibility of electricity superseding hydraulic power for lifts and cranes. This should provide an opportunity for stating the claims of the most recent electrical developments and possibly of learning, to our profit, of any shortcomings. Of less practical importance will be the question, also to be raised, of whether the grid is a real benefit, which recalls the debates of ten years or so ago; this will probably be more easily answered in a few years' time. At the subsequent weekly meetings in London (every Friday) the subjects will be generally only of indirect electrical interest until December 18th, when Mr. C. E. Ward will read a paper on "Electricity and Heat Treatment"—a subject that concerns the electrical engineer as closely as it does the metallurgist.

Turbo-Alternator Speeds

BRITISH power-station practice has hitherto limited the maximum 50-cycle speed of 3,000 r.p.m. to turbo-alternators rated at 30,000 kW. It is not until an output size of 50,000 kW is reached that the effect of increased capacity is enough to counterbalance a reduction to 1,500 r.p.m. The higher speed has, however, been adopted for the three 50,000 kW sets at St. Denis power-station, Paris, and although these have had their share of "teething troubles" (as a report in this issue indicates) maintenance work does not appear to have been unduly heavy. The thermal efficiency has averaged nearly 25 per cent. over two years, but this figure was exceeded in 1935 by five English stations, all with sets of 50,000 kW or over, running at 1,500 r.p.m. One would like to have an opportunity of comparing the performance of British sets of this size at 3,000 r.p.m. with that of the 105,000-kW and 75,000-kW, 1,500-r.p.m. units at Battersea and Barking.

Choosing Technical Equipment

AN expenditure of £12 million within the next seven years has been stated by the Board of Education to be required for the expansion of technical institutions. This is in addition to the normal outlay on equipment and it is clear that a revision of the present practice in the selection of apparatus is called for. The method that has served in the past, when erecting new or extending old training establishments, of visiting various colleges to inspect individual items of equipment is likely to prove far too cumbrous, and waste of time is not its only disadvantage. One obvious merit of the scheme sponsored by the associations representing technical institutions, of which we give particulars in this issue, is that a series of representative displays under various industrial classifications will be given, rather than a mere exhibition of technical equipment as such. At the bureau established at British Industries House information is obtainable regarding the latest developments, and competitive apparatus can be inspected. This is the first time, so far as we are aware, that a definite plan to facilitate the selection of technical equipment has been put into force, and it ought to be assured of support.

Electricity on Aircraft

THE minimum requirements for electrical apparatus (other than radio) issued by the Air Ministry (C.S.11) are, broadly, based upon B.S.S.229 for flame-proof enclosures in an explosive mixture of petrol and air and the attainment of a maximum possible temperature of 100 deg. C. For generators (which are not included in the series of British Standard Specifications especially relating to aircraft) that figure applies to any part of the windings, and is irrespective of rise of temperature. Plugs and sockets follow ordinary practice. A curious provision is that which sets a limit to the *maximum* efficiency of filament lamps. This is done in order to ensure "a reasonable life." As these values are about twice those obtained from lamps for general service at ordinary voltages, there should not be much difficulty in complying with this stipulation!

How Loads are Lost

THE risk of transformer breakdown nowadays can be reckoned as a minor one and the cost of duplication may represent an unnecessarily expensive insurance. Nevertheless, the organisation should allow for quick replacement if the unexpected happens. A correspondent tells us that a small seaside town was left without electricity for nine hours owing to the burning out of the transformer at the bulk supply point, due, apparently not to any inherent defect, but to overload occasioned by a sudden influx of visitors on a cold, dark day—surely a combination of circumstances that should have been provided for! One particular result was the rescinding of an order for the building of an all-electric house, and other loads have, no doubt, been lost as well for an appreciable time ahead. The prospective owner was possibly piqued by the manner in which he had just previously been reassured when he raised the question of reliability. He was, he states, informed by the undertaking's representative that the chief engineer would not permit a breakdown to occur! While confidence in a superior officer is certainly to be commended, its public expression should not attribute to him the power of working miracles.

Steam-station Performance

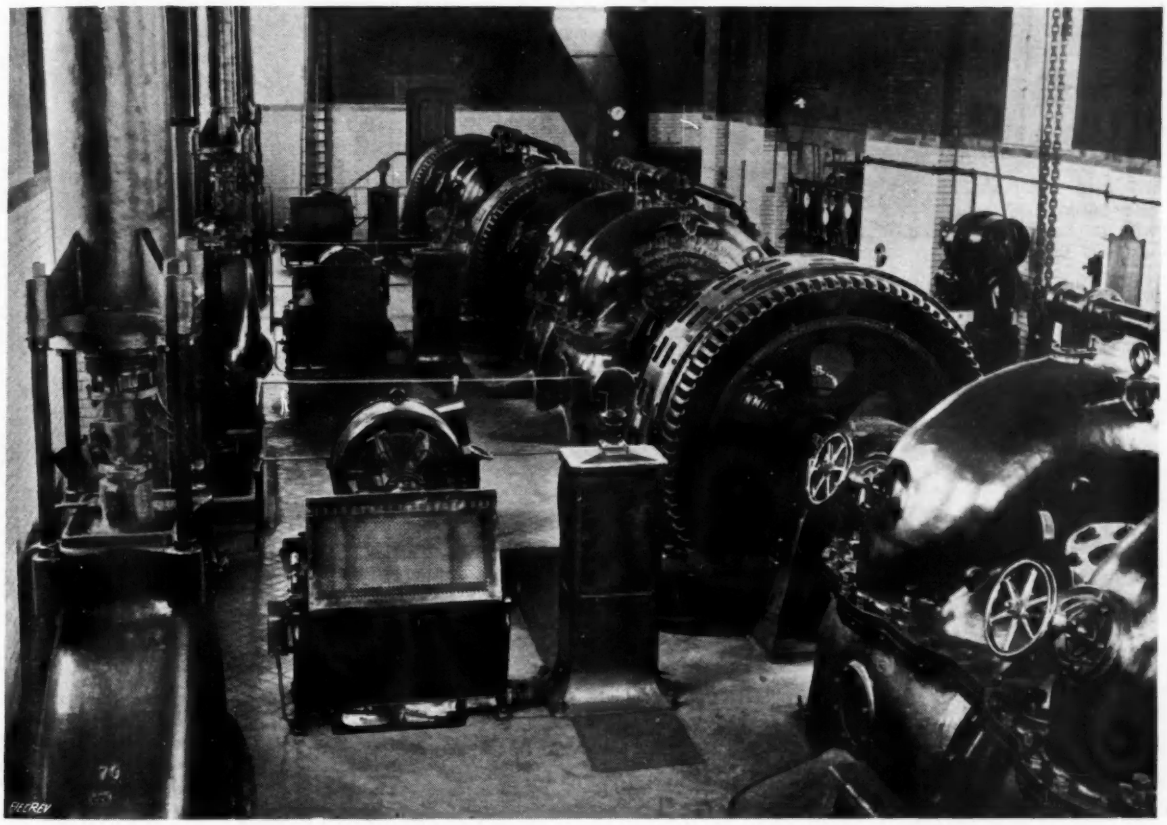
The consumption of 10,946 heat units per kWh generated which is stated in *Electric Light and Power* to have been achieved for the month of April by the Port Washington station of the Milwaukee Electric Railway & Light Co. is, we believe, the best result yet recorded for a coal-fired station. This gives a thermal efficiency of 31.7 per cent.—a figure exceeded by only one even of our oil-engine stations—and for the first five months of regular operation an average of 30 per cent. has been maintained. The high calorific value returned for the coal (13,130 B.th.u. in April) leaves little margin for error. Turbine steam conditions are 1,200 lb. per sq. in. and 825 deg. F., and reheating at the same temperature is employed. One 80,000-kW unit only (including a single boiler) is at present installed. In the list of the most important stations in the United States included in the article only one other, Deepwater, with a load factor of 87 per cent. and working with similar steam conditions, is shown to have given a better thermal performance than the three leading British stations—Battersea, Barking B and Dunston B—did in 1935, where the pressure is only 625 lb. per sq. in. Their performances are thus more properly comparable with the American Powerton station, which with 26.6 per cent. efficiency comes between them and Clarence Dock and Ironbridge. The average figure for all American stations is given as 18,669 B.th.u. per kWh, which appears to be about the same as in this country on an estimate of the usual calorific value of the fuel here.

Heavy-duty Pumping Installations

Electrical equipment at the Port of London docks

DURING our recent tour of the Tilbury, Royal and India groups of docks of the Port of London Authority, which we described in our issue of August 14th, we were much impressed by the widely varied pumping equipment devoted to raising water levels in wet docks, dewatering dry docks, and generating hydraulic power for operating all the equipment used.

A new pumping station at Tilbury is equipped for impounding water into the main dock for water-level raising and also for pumping out the dry dock. Two dewatering pumps are driven by 940-h.p., 3,000-V, 375-r.p.m. auto-synchronous motors, and the two impounding pumps are driven by 550-h.p., 3,000-V, 250-r.p.m. motors. All four of these motors start up as induction machines; they have separate rotor windings which are switched on direct by air-break equipment, and each motor has its own directly coupled exciter. For draining the dock there are two 105-h.p. vertical motors with automatic float-switch control, and an unusual arrangement in connection with these is a three-contactor resistance unit which, immediately before shutting down the motor, reduces the speed by, say, 30 per cent., thus easing the water pressure. This separate control unit has no influence on the starting up programme. Small motors operating sluice valves have hand control for closing and automatic control for opening, while for priming the main pumps there are 15-h.p. air-extraction pumps. All except the main motors in this station are d.c., 500-V equipments, and perhaps one of the most important features is the general lay-out of the main equipment, with the right-angle drives and pumps nesting in pairs, all at about 50 ft. below ground level.



Impounding pumps at Albert Dock station

The Ventilating System

It was a surprise to find the Visto ventilating system equipped with a 60-kW bank of Unity "Flood" heaters in the trunk. Although the heaters are arranged for thermostatic control, because the arrangement is mainly for damp prevention the thermostats are not normally used. All the motors in this station are of Crompton Parkinson manufacture, and all the control gear was supplied by Electric Control, Ltd. The main 3,000-V a.c. and d.c. main switchgear is all Reyrolle equipment.

Serving hydraulically operated gates, cranes and bridges, there are in a combined rotary sub-station and pumping station at Tilbury three 200-gal. per hour and three 60-gal. per hour pumps (800 lb. operating pressure). The larger machines are driven by 150-h.p., 500-V, d.c. Lancashire Dynamo motors and the smaller ones by similar motors of 45-h.p. capacity. They are all variable-speed machines (600/200 r.p.m.) and they are automatically controlled by the action of a hydraulic pressure accumulator. An accumulator limit switch first energises a master control panel. Chain driven by the up and down movement of the accumulator is a shaft with a driving disc for each field rheostat. The position of a tooth section on the periphery of each disc can be altered to suit the required sequence operation of the motors. With a "fall" of the accumulators, contact at the first stud of one of the face-plate type regulators operates the motor contactors, and by continued movement of the regulator arm, speed regulation is effected in the usual way. To avoid difficulties brought about by the motors running up to speed too quickly at starting a protection relay has been connected across each rheostat, and during its time lag the resistance is released in eight steps. Two 13-h.p., 600-gal. per min. motor pumps serve a 10,000-gal. storage tank for the hydraulic supply plant.

The sub-station portion of this station is operated by the County of London Electric Supply Co., Ltd., and it supplies the whole of Tilbury Docks. There are two 500-kW rotary convertors and the necessary distribution and transforming plant for handling the 3,000-V incoming supply.

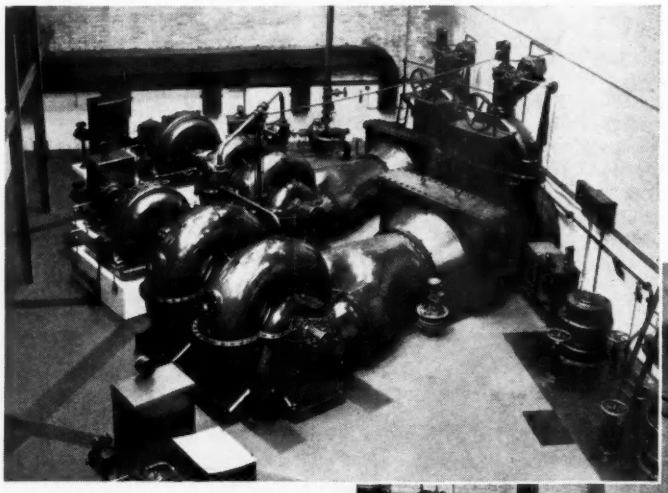
At the Victoria Dock in the Royal Docks group a sub-station with three 1,000-kW and two 300-kW Westinghouse rotary convertors deals similarly with the 6,600-V two-phase supply from the West Ham undertaking.

Pumps for Impounding Work

For impounding work at the Royal Docks there are in the pumping station at the Galleons entrance to the Albert Dock three 66-million gal. per hour pumps, each driven by a 434-h.p., 6,600-V, 195-r.p.m., two-phase Westinghouse induction motor with a linquid controller and served by extra-high-voltage liquid cubicle switchgear. This station also houses two pumps for hydraulic-power supply driven by 350-kVA, 3,300-V, 3,000-r.p.m. B.T.H. synchronous motors, which are run up to speed as ordinary induction motors at 1,300 V from suitable transformer tappings before the full voltage is switched on at synchronous speed. Hand regulation of ordinary resistance equipment and the directly coupled exciters provides for load-variation adjustment. Two 12-h.p., 500-V, d.c. motors

which drive 500-gal. per min. pumps, serving a roof tank by which the hydraulic pumps are gravity primed, are automatically operated by float-control equipment.

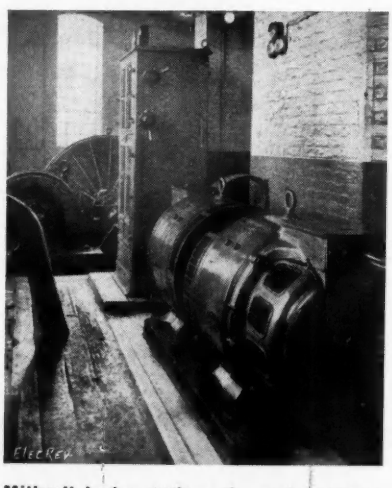
For dewatering the King George dry dock there are two 60,000-gal. per min. pumps, each driven by an E.C.C. synchronous motor, 820-h.p., 6,600-V, two-phase, 375 r.p.m.. Each motor is directly coupled to a 480-h.p. (20 min. rating) pony induction motor and an exciter. At starting the pony motor is switched in with a "shorting" resistance which is gradually cut out until the main motor is in step and put on line. Drainage of this dock is provided for by two 40-h.p., d.c. motor pumps and there are also two 15-h.p. motor pumps for station drainage.



Nested pumps at the Tilbury impounding and dewatering station (left), and the King George V dry dock dewatering station

In the dewatering station for the two Albert dry docks there are two 220-h.p., 250-r.p.m. synchronous motors driving 25,000-gal. per min. pumps. These motors operate at 220 V and each has a chain-driven exciter. A simple throw-over switch introduces resistance when starting up and when synchronism is attained by exciter regulation the "throw-over" is effected. An interesting conversion scheme in this station is represented by a couple of two-throw bucket pumps originally driven by steam engines. Now they are served by 35-h.p., d.c. motors with chain and reducing gear drives (336 r.p.m. to 52 r.p.m.), and the output of each set is about 500 gal. per min.

Compressed-air supply is also catered for in this station by four two-stage inter-cooling compressors, each capable of delivering 800 cu. ft. of free air per minute (supplying at 100 lb. per sq. in.) and driven by a 160-h.p. E.C.C. d.c. motor.



Millwall hydro station; the motor-generator set (near) supplies the variable field for the 300-h.p. pump motor at rear

In an impounding station for the West India, South-West India and Millwall Docks, the water of which is common to all three docks through cuttings, there are three 3½-million gal. per hour Worthington pumps, each driven by a 360-h.p., 440-V Lancashire self-synchronising motor with a separate exciter. The Brookhirst starting panels have sliding-resistance type field regulation. Two motor-driven air extractors exhaust the air from the pumps, thereby admitting water for priming. Kent electrical remote indicating and recording equipment for the river and dock water levels, in which resistance in the transmitting circuits is regulated by float controls, was seen in this station.

Providing for Automatic Operation

Automatic operation of the three 106-h.p. Lancashire d.c. motor drives in the East India Dock hydraulic station is provided by direct chain transmission from the accumulator to the Brookhirst starting equipments. The three regulator drives are arranged continuously in the one chain, but sequence operation is provided for as required by adjusting the relative gear positions of the gearing inside the starters. Two 8-h.p., 1,050-r.p.m. motor pumps serve the water supply tank.

In the East India Dock impounding station we saw the result of a recent supply change-over scheme by which two 75-h.p. and two 150-h.p., 440-V, three-phase G.E.C. induction motors with oil-immersed drum-type starters and circuit-breakers with push-button stops have replaced d.c. drives.

Two 175-kW, 480-V, d.c. Westinghouse generators employed as such in the days of private generation at the docks are now doing good work at the Millwall dry dock dewatering station by driving Gwynne pumps. Each pump deals with about 2,800 gal. per min. and the dock can be emptied in three hours.

Speed regulation between 600 r.p.m. and 200 r.p.m. is provided for a 300-h.p. Lancashire motor in the Millwall hydraulic station by the automatic regulation by pulley drive from the accumulator of a motor-generator set supplying the main motor field.

Canadian Industrial Power

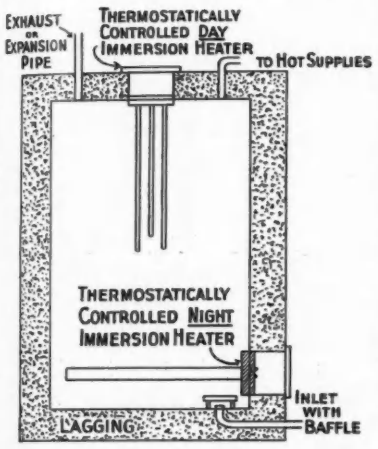
THE Dominion Bureau of Statistics at Ottawa, in a recent report on the use of electric power in the manufacturing and mining industries of Canada, shows the extent to which the electric drive has been adopted in recent years by Canadian manufacturing and mining plants. It is shown that the total capacity of prime movers in Canadian manufacturing industries rose from 1,188,211 h.p. to 1,464,783 h.p., an increase of 23.3 per cent. The electric motors operated by works-produced power rose in capacity by 54.1 per cent. and those operated by purchased power by 190.1 per cent. The total rose from 1,315,828 h.p. to 3,330,413 h.p., an increase of 153.1 per cent. Many Canadian manufacturing plants use the electric drive exclusively and scores of others have ratios above 90 per cent. This increase in the utilisation of electric power has been particularly prominent in the pulp and paper industry, which increased its ratio from 50 per cent. to 72 per cent. during the eleven years in question. Most of the energy utilised is derived from central electric stations. Canadian mining industries are nearly as completely electrified as the manufacturing plants, with the exception of colliery undertakings. The increase in ratio of electric motors to total power equipment during the eleven years has been from 57.3 per cent. to 75.1 per cent.

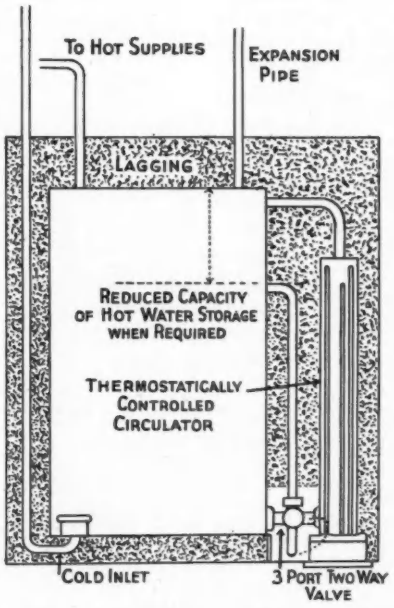
Installing Water Heaters. By Philip Honey

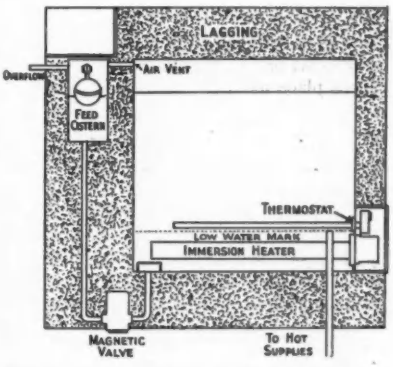
Different requirements and how they can be met

ANY one of the following water-heating requirements or a combination of them can generally be met electrically, either by immersion heaters or circulators in conversion schemes or by self-contained water heaters:—Quick recovery; control of loading; varying amount of storage water to be heated; control of radiation in summer; joint or alternative working with solid-fuel installation; electricity supplied on night tariff; day-time boosting; cold feed from main supply only; and limited position of storage tank.

Space available, tariffs chargeable and certain conditions of hot-water supply have a bearing upon the design of the equipment with the result that some manufacturers now specialise in "made to measure" water heaters.

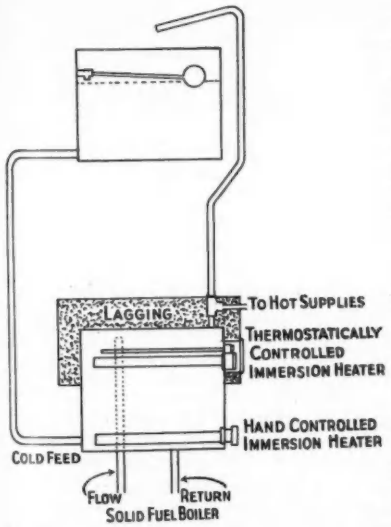






Left: Dual-heater hairdressers' tank. Centre: Two returns from an external circulator for part or whole heating. Right: A night heating and night filling industrial equipment

For example, a specially constructed water heater for a hairdresser's saloon is of considerable capacity as the temperature of the water in store is between 110 and 120 deg. F., needing little cold water in addition when used for shampoo sprays. This obviates the difficulty of maintaining a steady temperature at the spray and reduces the risk of scalding. The horizontal element is capable of heating the entire contents of the tank up to the maximum temperature in eight hours, and is supplied from the night-tariff circuit at a specially low rate. The vertical element is loaded just enough to counteract radiation losses and it heats practically only the water that is at the top of the tank. This element is operated at day-time rates, but there is a change-over switch fitted for emergency use which will also put the horizontal element on the day-rate circuit.



This heater warms the linen cupboard, but only when required

It is suggested that three-heat and thermostat control both have their particular spheres of usefulness, so why not combine the two? An installation with such combined control for a vertical top-entry immersion or circulator has the advantage of quick recovery, automatic control and, for general use, a loading sufficient to cope with the household's usual daily requirements.

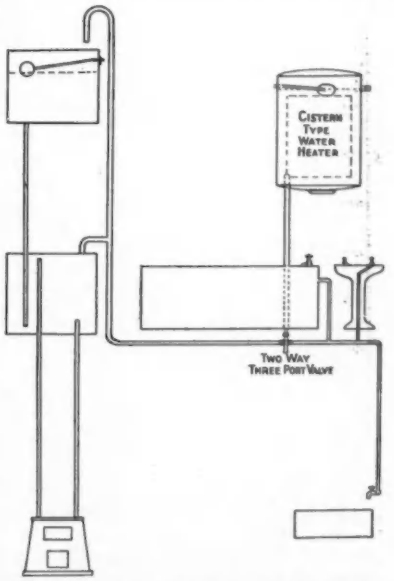
On low heat the low density of heat distribution is a factor conducive to low maintenance, as little furring will occur.

A refinement of the top and bottom heater tank provides heat for the linen cupboard only when it is required. With the top heater switched on only a small amount of water is heated and stored in the part of the tank which is lagged. When baths are required the lower heater is switched on and as the water is used very soon afterwards, no heat worth mentioning is lost from the lower part of the tank. When solid fuel is used in the winter the water in the lower part of the tank is for most of the day at a high temperature and supplies sufficient warmth for the airing cupboard.

Another method of providing part or whole heating for a storage tank is by means of an external circulator with its return tapped into the tank at two different levels. This system is on the lines of a well-known gas water-heating boiler, except that the lagging of the electrical scheme is infinitely superior. Some difficulty would be experienced with such an installation in hard water districts on account of the possibility of rapid furring.

An equipment familiar to many in the North has a top-entry circulator of such length that it heats only, say, 20 gallons and no more of 30 or 40 gallons, and provides an efficient and easy way of getting a hot bath at short notice. A three-heat switch controls the heater and lagging can be omitted when intermittent heating only is required.

Where an external circulator is introduced into the flow pipe of a solid-fuel system a two-way valve is necessary to divert the water past the circulator in the winter months when the fire is alight. There is nothing to prevent the use of both circulator and fire together if need be.



A two-way valve provides hot water from alternative sources

To meet the wishes of consumers who desired electrical heating of their water supply in conjunction with coal or coke the "series" system was introduced in which the heater was installed between the tank and the taps to ensure that the latter were always supplied with hot water. One of the difficulties experienced was that many consumers preferred to keep the

water heater out of commission in the winter, and perhaps the only way of doing this is by a two-way three-port valve at a junction of the two heater outlets and the electric heater inlet. Two ordinary stop-valves could be used, if desired, with the same effect, except that circulation of electrically heated water would take place if both valves were left open.

In passing, a comparison may be drawn with the usual practice of the gas industry by which a two-way valve gives the alternative of hot water from either of the two sources, but never from them both together. In the illustrated installation for providing a hot-water supply from either of two sources the electric alternative is a cistern-type water heater. Two stop-valves could be used instead if desired, but if both were open the contents of the higher tank would feed back up into the cistern water heater and overflow.

The connection of water heaters direct to the cold-water main is restricted in many districts to heaters of small capacity only. Where this is allowed, however, the force of the incoming water can be utilised for supplying hot water to an extra point, *e.g.*, a bath which is served by an open-ended pipe. With the stop-valve on the spout outlet of the water heater open the hot water normally finds its way to the sink as soon as the controlling valve is opened. When the stop-valve is closed hot water rises to the second point and is discharged into the bath. The flow of water is always controlled on the inlet side of the water heater, and expansion takes place at either of the two points.

A Continental type of night-tariff heater which was tried out in England some time ago and was not unsuccessful in soft-water districts, although its large size proved a disadvantage for the average small house in this country, has been constructed specially for industrial hot-water supply and is arranged to be accommodated on a factory roof. The unique control of both water and electricity gives ideal service conditions, because the heater is filled and heated during night hours and during the daytime hot water is available at a steady temperature at all times. Even in the event of boosting being required for one or two hours during the day, water is fed into the heater only at the speed at which it can be heated at a usable temperature.

A suggested system of night-tariff heating provides a "plug" pattern cold-feed valve interlocked with the heater switch. To obtain night-tariff conditions one must rely on the consumer and to a certain extent on his human nature and habits. When he retires for the night the water is turned "off" and electricity "on" by one operation. In the morning, when he rises, before he can obtain hot water, he must turn on the feed-water valve, which also turns the electricity "off." A boost can be obtained if necessary, and this may probably upset the otherwise purely off-peak conditions. The idea is worthy of further exploration, however, and even if a special rate is not charged for energy it might be possible to hire the heater at a reduced figure on account of its general load-levelling features.

A Tariff Line Chart. By R. W. Wilson, B.Sc., A.M.I.E.E.

An aid to choosing between flat rates and a two-part tariff

A HOUSEHOLDER who has the choice of two tariffs, one in which separate charges are made for lighting and power supplies and the other with a fixed charge based on the rateable value of the consumer's house, plus a small running charge for both lighting and power, is often uncertain which tariff it would pay him to adopt. A line chart constructed as described below and placed in a prominent position in the local electricity showrooms would, I suggest, assist the supply undertaking's clerks and the inquiring consumers to arrive at a rapid decision.

This line chart was drawn up to meet an actual case in which the electricity charges per kWh were either: flat rates of 4¾d. for lighting and 1d. for power, or a two-part domestic tariff composed of 15 per cent. on the rateable value up to £40, and 5 per cent. over, plus ½d. per kWh used for any purpose.

Three scales were set up (fig. 1), one representing annual consumption for lighting, one rateable value, and the third annual consumption for power. Suppose a consumer is at present paying for his electricity according to the flat-rate tariff and that his annual consumption for lighting is 120 kWh, and for power 700 kWh, his rateable value being £30. If a straight edge is laid across the chart so as to pass through A, the 120 kWh graduation on the lighting scale, and through B, the £30 graduation on the rateable value scale, it will be found also to pass through C, the point corresponding to 1,150 kWh for power. The consumer is clearly using too little power to benefit by a change-over. If he were to install some further apparatus which would raise his power consumption above 1,150, it would then be advisable for him to transfer to the two-part tariff.

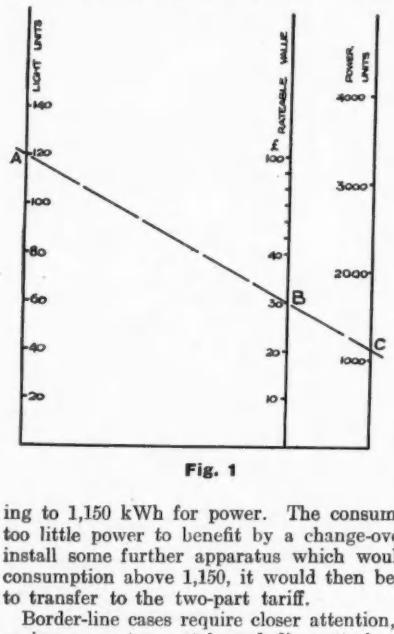


Fig. 1

Border-line cases require closer attention, as details such as saving on meter rentals and discounts become relatively important. In the case of a favourable change-over to the two-part tariff, the chart gives an approximate but rapid indication of the saving effected.

In the construction of the chart, take L and P as the kWh consumed per annum for lighting and power and R as the rateable value in pounds (=240 R pence). Then the charges according to the flat rate tariff would be $4\frac{3}{4}L+P$ and, according to the domestic tariff $15/100 \times 240R + \frac{1}{2}(L+P) = 36R + \frac{1}{2}(L+P)$.

Limiting condition for transfer is when

$4\frac{3}{4}L+P=36R+\frac{1}{2}(L+P)$ or $2P+17L=144R$ ..... (1)

The chart must provide axes for P, L and R, so that a straight edge will pass through corresponding values of these variables. Let x= kWh for lighting per in., y=rateable value per in. and z= kWh for power per in. on the appropriate scales. ABC is any straight line cutting the three axes (fig. 2). The lengths AA_1, BB_1 and CC_1 are equal to L/x, R/y and P/z. Using similar triangles, $(R/y-L/x)/(P/z-L/x)=a/c$, from which $P(a/z)+L(b/x)=R(c/y)$ ..... (2)

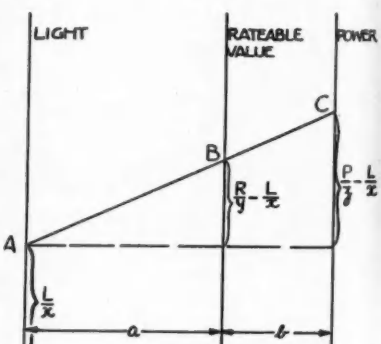


Fig. 2

Comparing equations (1) and (2) it is seen that $a/z=2$, $b/x=17$, $c/y=144$, so that $a+b/y=144$. Suppose it is decided to make x equal to 20 and y to 10. Then b=340 and c=a+b=1440, whence a=1100 and z=550. Hence scales will be suitable in which one inch represents 20 lighting kWh, 550 power kWh, and £10 rateable value. The base line must be subdivided in the ratio a/b=1100/340. A suitable arrangement would be a+b=7.2 in., a being 5.5 in. and b 1.7 in., or any multiple of these values.

In fig. 1 an adjustment of the rateable value scale was made above £40 so that one inch represented £30, in view of the reduction in the percentage charge above this value.

The Association of Supervising Electrical Engineers

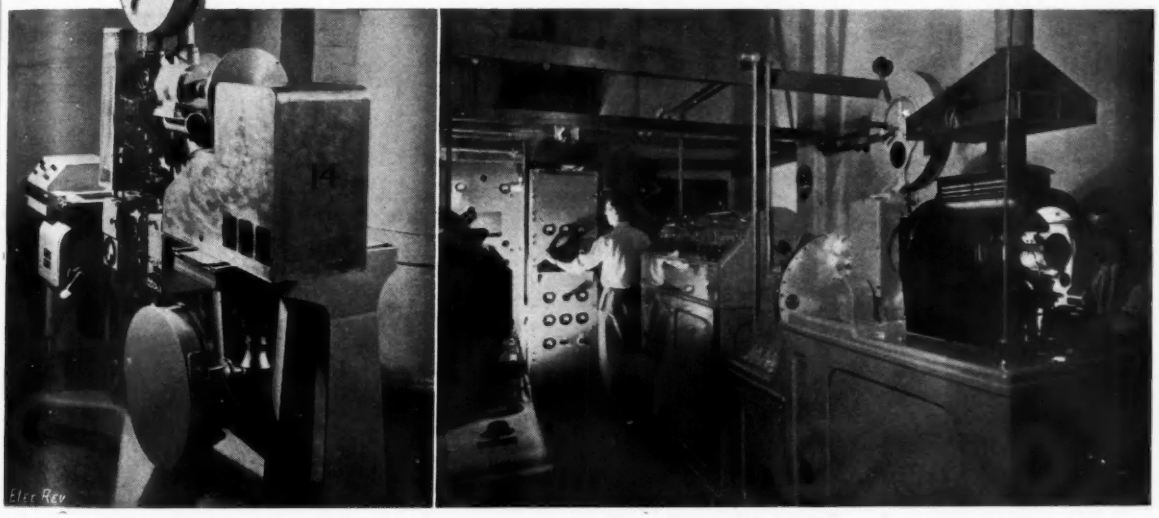
The 1936-37 session of the Association of Supervising Electrical Engineers will open on October 20th, when Mr. H. Hobson will deliver his presidential address. The papers to be given during the session are as follows: "Aluminium Bus-bars," by Mr. C. H. Ridpath; "Television," by G. C. Marris; "Developments of Domestic Load in relation to Tariffs," by Mr. F. W. Purse; an official paper on "Compulsory Wiring Regulations and Registration"; "Electric Refrigeration," by Mr. A. Kewley; "Metering Systems," by Mr. G. F. Shotter; and "The Provision of Internal Mains for Large Buildings," by Mr. D. Winton Thorpe. The annual dinner will be held on February 27th at the Trocadero Restaurant, W.

Public Television Commences

Transmissions from Alexandra Palace

THE Report of the P.M.G.'s Committee to consider the development of television as a public service contained a recommendation that an extended trial should be made of the systems of Baird Television, Ltd., and the Marconi-E.M.I. Television Co., Ltd., used alternately (ELECTRICAL REVIEW, February 8th, 1935). The B.B.C. has now given effect to this proposal by providing a sound transmitter and aerials at Alexandra Palace and by arranging with each of the two companies to provide a complete television chain, comprising studios, control room and 6.67-metre transmitters.

A 226-ft. tapering lattice mast on the reconstructed east tower, itself 80 ft. high, gives a total height of over 600 ft. above sea level for vision transmissions. Immediately below the vision aerial is that for the accompanying sound transmissions at 7.23 metres. The operating band ranges from 35 to 50 megacycles per sec., the working figure being 41.5 and the output power rating 3 kW at 90 per cent. peak modulation (Copenhagen rating). The vision transmitters, however, are rated in terms of instantaneous peak power delivered to the aerial at 100 per cent. modulation, which is 17 kW. On the same basis the sound transmitter would deliver 12 kW. The transmitter is in four units, each housed in a metal cubicle. The master oscillator (ensuring a stability of plus or minus one part in 100,000) operates at half the carrier wave frequency, and is followed by one frequency-doubling stage and five high-frequency amplifying stages. Modulation is effected at the anodes of the final high-frequency amplifier by choke control, modulator, sub-modulator and sub-sub-modulator stages of the conventional type being employed. In the final h.f. stage, two "C.A.T.9" water-cooled valves in push-pull are used, and in the main modulator stage three "C.A.M.3" valves in parallel.



Left: The Marconi-E.M.I. film transmitter ("Emitron" instantaneous camera unit in right foreground). Right: Baird "Telecine" scanners with monitoring and control racks at rear

The frequency response of the transmitter is substantially flat between 30 and 10,000 cycles per sec., the maximum departure being less than 2 db. over this range. The l.f. input stage (the sub-sub-modulator) is designed to operate from a signal which has an amplitude equivalent to that employed as a standard at all B.B.C. transmitters.

All the valve filaments are heated by d.c. from a 20-V, 300-A motor-generator set, the filaments of the early stages being fed through resistances. The main 6,000-V d.c. supply for the penultimate high-frequency amplifying stage, the power-output stage and the modulators is obtained from a hot-cathode mercury-vapour rectifier. Auxiliary h.t. and grid-bias supplies are obtained from metal rectifiers.

One operator is able to manipulate from a control table all the power supplies to the transmitter. All switching operations are effected by remote control. A sequence-starting switch ensures that sufficient time elapses between the application of each succeeding voltage to allow valves and other apparatus to warm up before the mains high-tension power is applied to them.

Among other features is the sloping runway down which the television camera can travel to a concrete "apron," approximately 1,700 sq. ft., on the terrace outside, forming a platform for televising open-air performances and experimental programmes.

The power supply for the whole building is obtained from the mains of the North-Met. Co. at 415 V, 50 cycles, three-phase, The two main studios, one for each of the television systems, measure 70 by 30 by 25 ft. high. For the E.M.I.-Marconi system, which is used on 405 lines interlaced, picture synchronisation and camera operation are governed by the working of a pulse generator. An oscillator driven from the supply mains drives in turn a master oscillator, from which two frequency dividers produce all pulses necessary. These are modified and distributed by a second oscillator system, which is independent of the mains frequency.

Potential differences of 2 mV or so are created between the mosaic particles on the front of a vision plate and a metal plate on the back when an image is received by one of the six "Emitron" cameras. Signals produced in sequence by the scanning of a cathode-ray beam (focused to one mm.) are fed to the first amplifier valve by an electrical contact on the back metal plate.

The camera can be used in normal daylight or studio lighting. Picture signals are fed into a head amplifier (incorporated in the camera) which comprises an input valve, two resistance-coupled amplifier valves and a pentode output valve. Motion of the scanning ray is controlled electro-magnetically. An eighteen-conductor cable (in lengths up to 1,000 ft.) carries signals to the main equipment and supplies scanning impulses and filament current for the camera as well as forming connections for the transmitting "Emitron" tube.

A corrector unit provides additional impulses to compensate for inequalities leading to shadows and the signals enter a phase-reverse unit. The latter provides alternative phase reversal by taking the output from either the cathode or anode of a single valve, thus enabling either positive prints or the negatives of films to be used. The mixer unit sorts out the signals from the six cameras, enabling any one to be selected. It is composed of two banks of six valves, each with a common anode circuit, the output of which is passed to a B amplifier. Signals for individual cameras are controlled by varying the grid-bias.

Further amplification of the signals is obtained in the B amplifier (a.c.) which has three resistance capacity stages and one output stage, and a potentiometer prevents alteration in modulation when changing from one channel to another. The third amplification valve reduces interference, which is further lessened in the C amplifiers, having three stages of amplification.

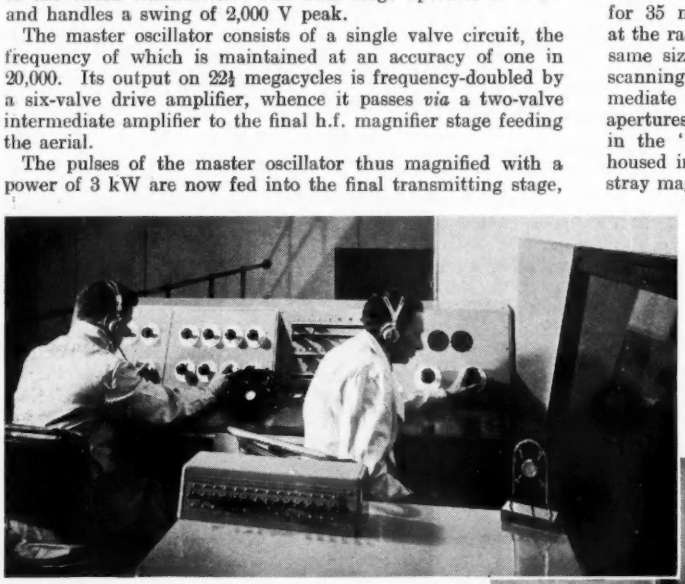
Duplicate suppression mixers convert the signal into d.c. by means of a diode rectifier. The five-valve unit includes two amplification stages. Synchronising impulses to be transmitted with the picture signal are added in the "Synch. Mixer," the first stage of which is a diode for preventing an excessive d.c. input. Signals for the diode are fed to the grid of an amplifier valve in the anode circuit of which is a second valve fed with high and low synchronising pulses. This output passes through a d.c. coupling unit to the grid

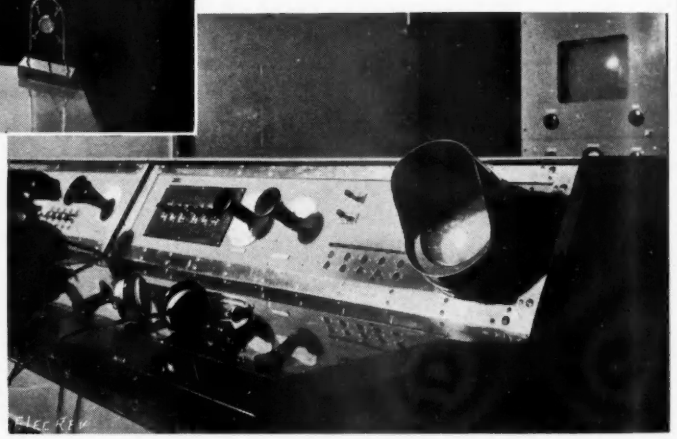
of the output valve, a portion being diverted *via* its cathode to two modulation meters. Complete signals to be radiated are now fed to the distribution amplifier, consisting of an input stage and five alternative output stages.

Picture signals from distant points can enter the transmitter system through one-stage line amplifiers, each with a low-impedence output stage. Three modulator units follow, in the eight valves of which a high-power modulating signal is passed to the vision transmitter. The final stage operates at 5 kV and handles a swing of 2,000 V peak.

The master oscillator consists of a single valve circuit, the frequency of which is maintained at an accuracy of one in 20,000. Its output on 22½ megacycles is frequency-doubled by a six-valve drive amplifier, whence it passes *via* a two-valve intermediate amplifier to the final h.f. magnifier stage feeding the aerial.

The pulses of the master oscillator thus magnified with a power of 3 kW are now fed into the final transmitting stage,





Two control rooms: that on the left is for the Marconi-E.M.I. system and the right-hand one for Baird television and sound

consisting of two water-cooled valves supplied at 6 kV and giving a linear power output to a tuned aerial feeder to the vision transmitter aerial. The E.M.I.-Marconi sound equipment includes twelve amplifiers for all microphones, film emitron units and turntable outputs, and feeds them into the jacks on a sound control desk. The distribution system employs no valves, relying on circuit design only.

In its section the Baird Co. has installed three types of scanner—spotlight, intermediate film and "Teleciné"—the number of lines forming the image is 240. The spotlight scanner is employed for close-ups or semi-extended views in the studio, and the intensity of illumination required corresponds to that for normal room lighting. A beam of light from an arc lamp is focused through a small water-cooled rectangular window at the top of the scanning unit, which has two discs running in vacuum, each driven by a separate synchronous motor, also running in vacuum. The scanning disc, running at 6,000 r.p.m., has 240 apertures, arranged in four spiral traces near the outer rim; the second disc, with a slit arranged in spiral trace near the rim, acts as a rotating shutter, so that only one of the apertures is exposed at any instant to the light beam.

A line synchronising impulse generator, consisting of a light source, optical system, photo-electric cell and 240 synchronising slits in circular trace on the scanner itself, in conjunction with an amplifier system, produces square-topped synchronising impulses at the end of every scanning line.

The spotlight beam for the scanning unit is focused through the window of the projection room into the studio and is then reflected from the televised subject on to four five-stage photo-electric multiplier cells. The output from each of the latter is fed to the "A" amplifier console, from which the signal passes to the "B" amplifier console in the projection room and thence to the output control amplifier. The signal, together with the line frequency synchronising signal, then passes to the control room.

The intermediate film scanner televises scenes in the large studios. The subject is photographed on 17.5 mm. film by a motion-picture camera, the unit being driven by a 1,500-r.p.m. synchronous motor. A sound-recording camera records the sound track between the perforations and the edge of the film. The complete operation, including processing, takes about thirty seconds.

The image on the film in the water-filled scanning compartment is projected by an automatic mirror arc lamp, focused through a slit in the guide, on to a scanning disc driven at 6,000 r.p.m. with sixty apertures in a circular trace near the water rim. Variations of light through the apertures are focused on to a ten-stage multiplier photo-electric cell. Square-topped synchronising impulses terminating scanning lines are produced by a line synchronising impulse generator. The scanned film now passes over a guide in a water-filled container, where variations of light are focused on to a photo-electric cell. It is then wound ready for transmission by a "Teleciné" machine.

The "Teleciné" scanner is designed to provide television for 35 mm. sound film, which is fed through a projector at the rate of twenty-five frames per second. An image of the same size as the frame is thrown through lenses on to the scanning unit, which is similar to that used with the intermediate film machine. Variations of light through the disc apertures are focused on to a photo-electric cell incorporated in the "A" amplifier which, with the "B" amplifier, is housed in one c.i. two-section unit to minimise pick-up from stray magnetic fields.

The six-unit monitor rack for each machine enables an outgoing picture to be viewed. One unit is a "Cathovisor" cathode-ray tube (of the type included in home receiving sets) and a rectifier unit operated at 6 kV. A second is a frame signal generator, including a three-phase 1,500 r.p.m. synchronous motor driving a disc with one slot on the outer rim that interrupts a beam working in conjunction with a photo-electric cell. The output from the latter is fed to a two-stage amplifier connected to the control room. Other units are three with cathode-ray tubes for scanning, modulation and viewing, an electro-magnetic scanning system, and a vision amplifier unit. Every scanning amplifier used has a substantially flat overall characteristic between 10 cycles and 2.3 megacycles.

Vision signals, line and frame synchronising impulses, and sound signals from each scanner are fed to the control room, where any one signal sound is made to modulate the two ultra-short wave radio transmitters, and any adjustment can be made in the level required. An oscillograph enables the wave form of the complete picture or a complete line to be viewed.

The transmitter comprises three main panels and an associated cubicle holding the smoothing circuits. The first is the constant-frequency drive equipment, with crystal oscillation at 1.406 megacycles per sec.; frequency-doublers and amplifiers give an output of 100 W at 45 megacycles that is fed through a concentric feeder to the grid circuit of the drive stage.

The drive stage comprises a water-cooled tetrode having an input of about 10 kW supplied from a 7 kV d.c. generator, the screen being fed from a 2 kV generator on the same shaft. Into this stage is injected from the appropriate modulation amplifier the line and frame synchronising impulses which are then amplified and passed to the output stage. The output power stage comprises a water-cooled tetrode with a maximum output of 50 kW supplied from a 10 kV d.c. generator; the screen is fed from a separate channel coupled to the anode supply machine.

Other principal contractors engaged were: Sound transmitter and transmitting aerials and feeders, Marconi's Wireless Telegraph Co., Ltd.; film-projection equipment, G.B. Equipments, Ltd.; wiring, Bective Electrical Co., Ltd.; power and lighting switchgear, Drake & Gorham, Ltd., and Johnson & Phillips, Ltd.; studio lighting, Strand Electric & Engineering Co., Ltd., and United Metal & Neon Works, Ltd.; Holophane, Ltd., and Kandem Electrical, Ltd. Buildings: Higgs & Hill, Ltd.; mast, J. L. Eve Construction Co., Ltd.; floors, staircase, bays and mullions, Helical Bar & Engineering Co., Ltd.; heating and ventilating, Rosser & Russell, Ltd.

Nickel-alloy Magnets. By A. B. Everest, Ph.D.

Typical applications illustrating advantages obtainable

STEELS of almost any desired combination of properties can now be produced by suitably heat-treating the basic nickel-iron alloys containing, in small or large proportions, nearly all the known metals. Striking contrasts in magnetic properties of one and the same series of alloys can be produced. Thus the permeability of pure iron is gradually reduced by additions of nickel exceeding 10 per cent., the non-magnetic state being reached with about 30 per cent. nickel (depending upon the carbon content).

More nickel, aided by appropriate heat treatment, very greatly increases the permeability and correspondingly reduces the hysteresis losses, so producing the softest material (magnetically) that is commercially available, while substantial proportions of nickel and aluminium impart a marked degree of magnetic hardness, such as is desired for making permanent magnets of great strength.

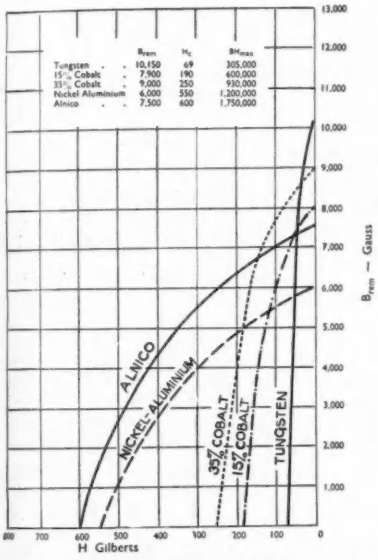


Fig. 1.—Typical demagnetising curves

These newer alloys are superseding other steels previously used for many purposes. A typical composition ("Alnico") contains 20 per cent. nickel and 10 per cent. each of aluminium and cobalt. Their advantages may be summarised as high energy for relatively small cost. Indeed, they offer greater magnetic energy per unit volume or weight than any other steel hitherto available to the manufacturer. Small cost is ensured not only because a smaller volume of the material is needed for a given result, but also by the relative cheapness of the alloys themselves; and, moreover, their specific gravity is smaller than that of cobalt steels, representing a further saving when actual weight of the magnet is taken into consideration.

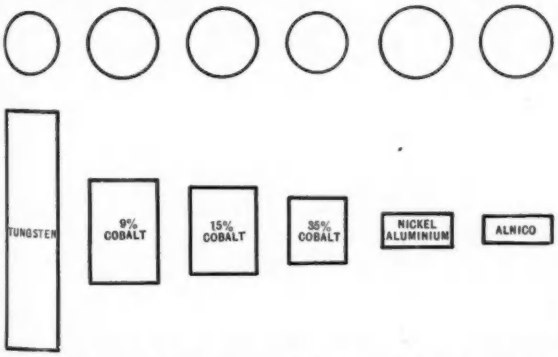


Fig. 2.—Relative sizes of magnets for the same energy and performance

A particular attribute of this series of alloys is the very high coercive force they possess (fig. 1), the remanence in most cases being lower than that obtainable with the older types of steel. On this account magnets made of the newer materials are generally of greater cross sectional area for a given result, but they can be employed in very much shorter lengths than was the case with the older steels (fig. 2).

They are exceedingly stable in service, even under the influence of temperature and shock, being superior to 36 per cent. cobalt steel, which was considered to be the best magnet material previously obtainable, with a BH max. value of about 1.1 millions. The average value of the straight Ni-Al type is 1.25 millions, which compares with a commercially available Ni-Al-Co value of 1.6 millions, while 1.76 millions is readily achieved in certain small sizes of magnets and under laboratory conditions almost 2 millions has been recorded.

In order that this new metal may be employed to its best advantage magnets made thereof have to be quite differently designed, which, in turn, frequently necessitates the appliance of which the magnet forms part being substantially redesigned too. For instance, radio loudspeaker magnets made of the older cobalt steels were of the cast claw pattern, whereas the earlier Ni-Al types (not being easy to cast) were built up of short blocks or cylinders of alloy, magnetised and then clamped between soft iron plates which, with the centre pole piece, formed the magnetic circuit. Improved casting technique now enables the latest hollow form to be cylindrical (fig. 3) or square.

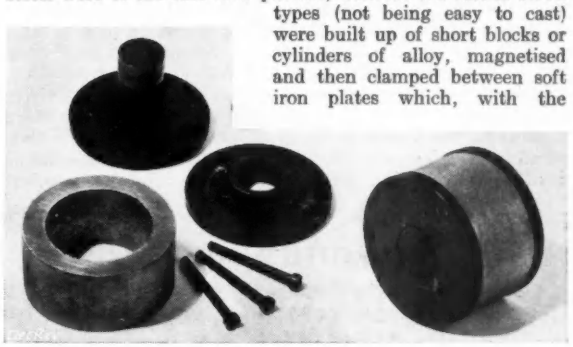


Fig. 3.—Assembled and "exploded" views of loudspeaker magnet

So-called non-electric chucks, which are self-contained, are made of Ni-Al-Co steel with little, if any, less magnetic holding power than that obtainable by excitation from an external source. An object is held on, or released from, the chuck face by turning a handle which moves a floating magnet system so that pole pieces in the face of the chuck either form extensions of the magnets or short circuit them and thus act as keepers.

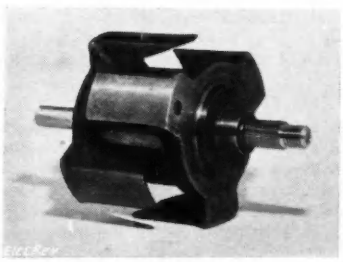


Fig. 4.—Rotor of miniature a.c. generator

Nickel alloys are specially adaptable to the manufacture of small motors and magnetos, while similarly constructed small speedometer generators are a good example of the short thick shape of magnet employed (fig. 4), the actual rotor poles being formed by soft iron extension caps at each end of the cylindrical magnet.

Other applications are to small generators for aircraft radio equipment, compressed-air-driven turbo-generators for miners' lamps, and moving coil instruments. It also seems likely that advantages may be obtainable by redesigning miniature synchronous motors, and even electricity meters, to suit the newer magnetic materials.

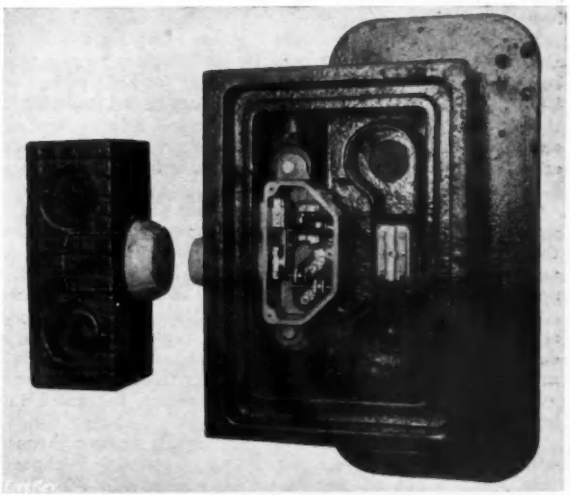


Fig. 5.—Tram-track detector for street traffic signals

A typical example of concentrated energy is the magnetic detector used in connection with automatic street traffic crossing signals actuated by tramcars which collect power from underground ducts. A massive permanent magnet holds an armature in the "on" position (fig. 5) across a wide air gap. The device is so placed that the tram's steel collector shoe suspended in the underground duct passes through the gap, thus deflecting the magnetic flux, which releases an armature whose contacts transmit an impulse to the master controller governing the signal lamps.

A somewhat similar application is to railway signalling devices now in course of development, whereby a large magnet fixed to the permanent way is made strong enough to actuate a magnetic relay on a locomotive at a distance of 6 in. or more while the train is passing at high speed.

This class of alloy was originally introduced for inductively loading cables, but the newer varieties are being increasingly applied to the manufacture of electro-magnetic instruments of all sorts, relays and radio components. A striking example is afforded by small transformer stampings; for an equivalent inductance of 80 henrys a silicon-iron core of 68 laminations weighing 1.5 lb. would be needed, whereas 12 laminations of less than a quarter of the size and weighing $\frac{1}{25}$ lb. suffice when nickel-iron is employed.

While judicious composition, heat-treatment and preparative manipulation have yielded a selection of alloys of very different electrical properties, mainly for specialised uses, such additional characteristics as resistance to corrosion, extreme ductility and possibility of producing non-magnetic castings of great toughness and strength are expected to be of more general utility.

The latest additions to the series are the "Honda" alloys containing from 15 to 36 per cent. cobalt, from 10 to 25 per cent. nickel and from 8 to 25 per cent. titanium, with or without small amounts of aluminium, providing a remanence of 7,000, coercive force of 840 and a Br. × Hc. value of six millions. These figures are substantially in advance of those of other magnet steels, but the newest metals are expensive to produce and consequently have not yet been utilised commercially to any great extent.

Faults in Motor Drives. By C. H. Smith

Suggestions for their avoidance

A MECHANICAL link is necessary for an electric motor to transmit motive power to some other device, and this is usually a belt, chain, gear or coupling. It must be remembered that the actual driving force of the motor arises in its copper conductors and is transmitted to the iron core (and thence to the shaft) *via* the insulation. Unfortunately, materials with good electrical insulating properties rarely possess great mechanical strength, and it is perhaps remarkable that such materials as cotton and paper, mica and varnish will successfully transmit loads of many horse-power over long terms of years.

The conditions being already arduous, every care should be taken to avoid making them worse, yet motors are sometimes subjected to heat and vibration in situations where such conditions can be avoided. The mechanical drive may be given insufficient thought, and when failure occurs the motor is held to blame.

Belt Drives

Excessive tightness of the belt is a fault which is met repeatedly. Damp weather may cause the belt to contract, and it is not uncommon for the electrician to be called out on Monday mornings, especially in the winter, to attend to a motor which is blowing fuses when the fault is solely due to overload imposed by temporarily tight belts.

Vertical drives are another source of trouble. If the motor is above, the full weight of the belt (which may be considerable), hangs on the motor pulley. If the motor is below, a tight belt is usually necessary to ensure a grip on the motor pulley. This type of belt drive can often be avoided if sufficient consideration is given before installation. Afterwards, a change may be difficult on account of the proximity of other machines.

Very short drives are even worse offenders, especially when the ratio between the pulleys is considerable. A tight belt becomes essential to avoid belt slip. This difficulty can now be overcome by the use of a "vee" belt or belts. The grip of this belt in its pulley enables it to run comparatively slack, and by using a number of belts in parallel large powers may be transmitted. It may not be necessary for both pulleys to be of the "vee" type; the larger pulley can be flat faced when there is a large arc of contact. Since "vee" belts are endless and cannot satisfactorily be joined, the drive should be at the ends of the shafts rather than in the centre to avoid threading the belt past hangers, &c.

The effect of a tight belt is to increase the loading on the motor (there are many cases where the power required to drive the shafting and belts *only* is a large proportion of the total output) and this may lead to overload. The trouble is often aggravated by belt fastenings which are stiff or uneven. The resultant knock on the pulley causes vibration, which eventually damages the insulation and leads to electrical failure, a defect which is regarded as a cause instead of being recognised as an effect. Bearings are liable to suffer from this cause and may allow fouling of the motor or armature, for which the bearings are unfairly blamed.

Faulty alignment of the driving and driven shafts will cause end-play, which, if severe, again causes knocking. Though this defect is not by any means so common, it should be guarded against.

Chains and Gears

Chains require more care in fixing than do belts, but they are less likely to give trouble. If they become faulty they advertise the fact more loudly and so receive earlier attention. Perhaps the commonest fault is a tendency to stretch, which may result in the chain jumping a tooth and becoming jammed. Care is needed to ensure that gears are correctly meshed; when they are too deep in mesh a severe load is thrown on all parts and shafts may be bent or broken. To avoid this, gears are frequently too lightly meshed, which results in excessive wear and often broken teeth. If correct meshing is obtained the life of gears is greatly prolonged and noise much reduced.

End play is not permissible with helical teeth, but with straight cut teeth many engineers do not trouble about it. If a raw hide pinion having steel end-plates or shrouding is used considerable trouble may be experienced from end-play, due to the wheel riding alternately on the raw hide and the steel shroud, especially as the latter may be less worn than the raw hide and so cause a "bump," which is transmitted to the motor windings.

Couplings

A properly designed and fitted coupling will transmit power without throwing strain on the motor other than that of the load itself. Unfortunately, the flexible coupling is often used as a substitute for proper alignment between the coupled shafts. When shafts are not coaxial the remedy too frequently advocated is "fit a flexible coupling" rather than "align the shafts." Admittedly, the former is the easier course, but it is only a palliative, and eventually the working of the various parts will cause trouble. The time and trouble involved in securing exact alignment will be repaid in the satisfactory running of the machines throughout their lifetime. Perhaps if the erector were to be made responsible for the subsequent maintenance there would be fewer complaints.

The real purpose of a flexible coupling is to damp out shocks arising in the driven machine and so prevent their transmission to the motor. For this purpose it is invaluable, but it is no substitute for true alignment. When the driven shaft oscillates or "wobbles," some type of universal joint is indicated, not a flexible coupling, unless a type is specially designed for such service.

It should not be forgotten that, in time, foundations settle down and may cause an originally satisfactory coupling to become out of line. The two coupled machines should be mounted on a common substantial bedplate and the machines located by dowels so that they will be accurately replaced if there is any occasion to remove them for cleaning or adjustment. Also most machines work best if the shaft is level. Where the motor has to work inclined to the horizontal its makers should be consulted as to its suitability for this duty and, if necessary, thrust bearings fitted to take the axial load.

Turbo-generators with Hydrogen Cooling

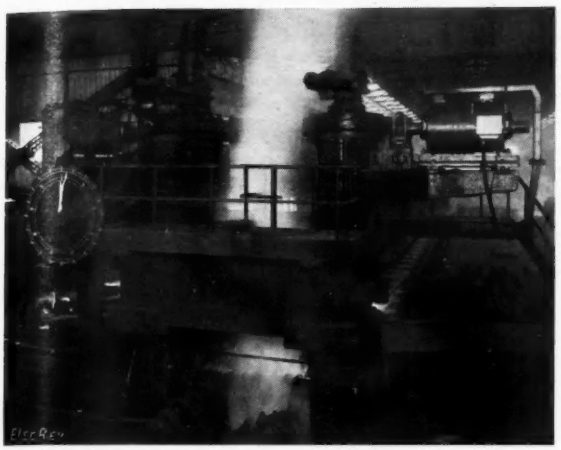
The two 60,000-kW turbo-generators now being built by the General Electric Co. of America for installation at the Windsor station of the Ohio Power Co. and at the Beach Bottom station of the West Penn Electric Co. are unusual in several respects. The turbines will be the largest high-pressure, non-condensing, high-temperature machines built to date, and the generators will be the largest to operate at a speed of 3,600 r.p.m. as well as to utilise hydrogen cooling. The machines are designed for 1,250 lb. gauge pressure, 925 deg. F. total temperature and 235 lb. gauge back-pressure. The Windsor station serves both the Ohio Power Co. and West Penn Electric Co.'s system and is jointly owned by the two companies. The new machines compare with the similarly cooled G.E. set of 40,000 kW on order for the Appalachian E.P. Co. and the 50,000-kW Westinghouse sets on order for the West Penn P. Co. and the N.Y. Edison Co.

Motors for Steel Works. By "Engineer"

Design and ratings

THE numerous duties which electricity performs in the average steelworks include ore-handling, crane work, mill table duty, screwdown gear, billet pushing, shearing, sawing and crushing. The motors employed for these purposes are of special design to withstand the severe duty with minimum attention, and all parts are arranged so that they may be quickly and easily renewed.

Mill motors have distinctive features and are totally enclosed. The armatures are of small diameter to keep the inertia low and allow rapid acceleration. For these reasons



Screw down motors on mill

the armatures must also be well banded and their insulation is of mica and asbestos to withstand heavy overloads and consequent heating. The use of commutating poles reduces injurious sparking when the motors are suddenly reversed under load or during momentary overloads, so increasing their life and reliability.

The frames of the machines are of cast-steel, the horizontal halves being dowelled and bolted together. The joint is machined to give a low reluctance path for the flux in the field system. The feet are wide spread out to assist in keeping the centre of gravity low.

As an additional precaution against the coils tending to fly out of the armature they are also wedged in the slots, and the armature and commutator are mounted on a cast-iron spider to permit of easy withdrawal in case of emergency. Journal bearings are provided, since ball bearings will not stand up to the heavy sudden overloads. They are made the same at both ends of the machine for interchangeability.

Mill motors are designed for intermittent loads and three different ratings are usual; 1-hour and ½-hour rated motors are used on cranes, screwdown gear, &c., while the root mean square method of rating should be adopted in all cases in which the service is intermittent and follows a definite cycle. For example, if 50 h.p. is required for 30 sec. and zero h.p. for 30 sec. (the load to be constant during each period and the time of working to be 6 hr.) then :—

$$\text{r.m.s load} = \text{max. load} \sqrt{\frac{\text{Time on load}}{\text{Time on + time off.}}}$$

$$= 50 \sqrt{\frac{30}{60}} = \frac{1}{\sqrt{2}} \times 50 \text{ h.p.}$$

$$= 35.5 \text{ h.p. equivalent continuous rating.}$$

If the motor has to carry varying loads at different times as follows: 25 h.p. for 10 seconds, 50 h.p. for 20 seconds, and zero h.p. for 30 seconds, then the calculation is as follows :—

Total cycle = 60 seconds, and time of duty = 6 hours.

$$\text{H.p. (r.m.s.)} = \sqrt{\frac{(25 \text{ h.p.})^2 \times 10 \text{ sec.} + (50 \text{ h.p.})^2 \times 20 \text{ sec.}}{60 \text{ sec.}}}$$

$$= \sqrt{937.5} = 30.5 \text{ h.p. cont. rating.}$$

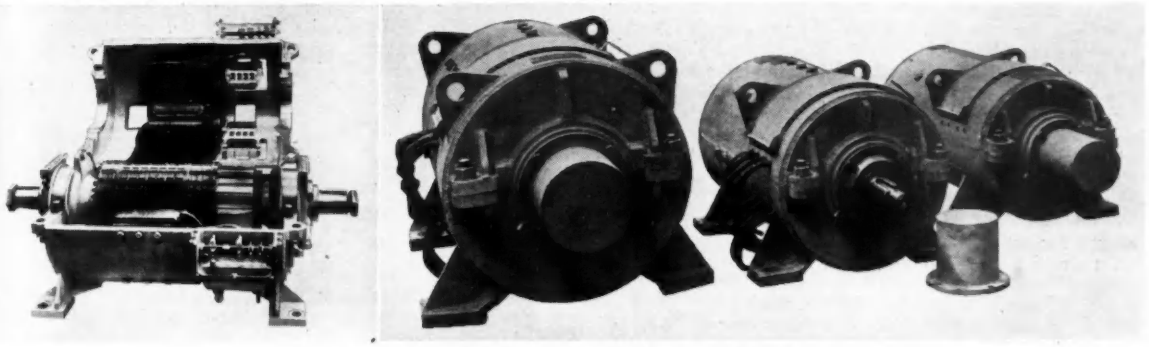
The most arduous class of duty is that typified by the tippler with a similar cycle of operations to the following :—Filling, 50 h.p. for 10 sec.; raising, 100 h.p. for 10 sec.; moving, 5 h.p. for 10 sec.; opening, 20 h.p. for 10 sec.; returning, 5 h.p. for 10 sec.; lowering, 50 h.p. for 10 sec.; a total time of 55 sec.

Then h.p. (r.m.s.) =

$$\sqrt{\frac{50^2 \times 10 + 100^2 \times 10 + 5^2 \times 10 + 20^2 \times 10 + 5^2 \times 10 + 50^2 \times 10}{55 \text{ sec.}}}$$

$$= 51 \text{ h.p. cont. rating.}$$

The equivalent continuous ratings are for 6-hr. rated machines.



Construction of a mill motor and three typical designs

Operation Results at St. Denis. By S. H. Kahn

Characteristics of the three turbo-alternators

THE first section of the St. Denis power station of the Société d'Electricité de Paris, described in the ELECTRICAL REVIEW of December 29th, 1933, has now been in operation for a little over 2½ years. An outstanding feature of the installation is that the three 50,000-kW (m.c.r.) turbo-alternators run at 3,000 r.p.m.—said to be the biggest capacity for that speed. The turbines were built by separate manufacturers, *i.e.*, Alsthom, Oerlikon and Brown Boveri; two of the alternators were built by Jeumont, and the third by the Ateliers de Constructions Electriques de Charleroi to Jeumont design.

The three turbines are of dissimilar design and have shown slightly different operating results. The common characteristics are as follows: Steam conditions are 768.8 lb. per sq. in. and 842 deg. F. (maximum 896 deg. F.). The condenser surface in each case is 30.13 sq. ft. and the vacuum at full load 96.8 per cent. The rotor of each alternator, weighing almost 30 tons, is small for its capacity, due to the system of ventilation. This embodies canals at each side of the winding slots which permit the air to come into direct contact with the winding.

In the operation of these alternators two of them showed some slight defects in balance on a Schenk machine. The addition of weights on the light side having been found insufficient, holes were drilled into the other side to rectify this.

Some trouble was experienced with the oil pump of No. 1 turbine (Alsthom reaction type) due to insufficient clearance in the flexible operating shaft. The gears of the pump were stripped and replaced by steel gears.

Abnormal Vibration

In No. 2 turbine (Oerlikon) the joint on the casing consisted of labyrinths followed by carbon rings of a type similar to that used on a low-pressure turbine. These rings seem to have caused abnormal vibration in running. They were replaced by a full labyrinth, but on starting, vibration and the play of the labyrinth were considerably increased. To overcome this the play of the casing was increased and normal

operation was possible provided the machine was heated up for about 1½ hr. before being run up to speed. This difficulty was probably due to deformation of the high-pressure section during heating up. The method of floating the high-pressure section on its bearings is now being modified and the difference in size of the upper and lower parts of the stator is being reduced.

No. 3 turbine (Brown-Boveri reaction type) presented a little difficulty with the regulation valves. These are without plastic packing and pressure tightness was secured only by the valve stems in steel sliding in cast-iron guides. These guides expanded, causing the valves to stick, and they have been replaced by steel guides. After three months of operation rapid wear of a thrust bearing resulted in deterioration of the blades. This seems to have been due to a change in direction of pressure on the bearing with sudden variations in load, the segments being caught successively instead of simultaneously on account of the taking up of the play. A new bearing with an elastic ring to take up the play has been installed. A number of blades were also broken last November due to the axial displacement of the Curtis wheel, apparently due to defective mounting. The wheel has now been welded into a collar which is itself welded on to the shaft. This has given satisfaction so far.

Apart from these details the turbines are said to have operated without maintenance beyond the normal. One point which was found to require exceptional attention was the oil circulation. Difficulty was experienced with a thick deposit consisting principally of asphalt and iron oxide. The machines were thoroughly cleaned and supplied with new oil, and centrifugal separators were put into the oil circuit to remove such impurities. It was found necessary to continue the oil circulation for three or four hours after the stoppage of a turbine to prevent the heat from burning the oil. Under these conditions the oil gives a deposit of 8 to 10 oz. per day for the first few days, but after operation for a period this deposit drops to about ¼ oz. or less per day.

Thermal Efficiency

Tests carried out on Nos. 1 and 3 turbines have shown the heat consumption (approximately the same in each case) to be 9,520 B.th.u. per kWh, at the most economical load of 40,000 kW. The load curve would permit the running of one generator only for four hours at night, but in view of the length of time required to start and stop a generator of this size and the risks inherent in doing so, two turbines are kept running at all times, except on Saturday afternoons and Sundays. In spite of this operation of an unnecessary machine, the mean thermal efficiency of the station over two years was 24.8 per cent. Tests carried out for constant loads of 85,000 to 90,000 kW with two machines running have given a thermal efficiency of 27.5 per cent. Taking into consideration the reheating of the feed water in four stages to 350 deg. F., the theoretical thermal efficiency of the whole unit running at optimum load is about 35 per cent. This figure has been confirmed by tests.

The Mercury-jet Wave. By W. E. French, M.I.E.E., A.M.Inst.C.E.

THE eminent suitability of the mercury-jet wave for d.c./a.c. mutation and high-voltage transmission, as well as the principles underlying its operation, have been discussed in previous articles in these columns.† The mercury-jet wave working as d.c./a.c. mutator, which was demonstrated for the first time in this country by the author during a visit of the North Midland Centre of the Institution of Electrical Engineers to Leeds University on January 23rd, 1934, required only the simple test arrangement illustrated. The experiment was, of necessity, a small-scale one, the total power involved not exceeding 5 kW.

Operation as d.c./a.c. mutator*

Since only a single commutator or single-phase mercury-jet wave mutator was at our disposal at the time, the tests had to be conducted on a single-phase supply as shown in the diagram. The d.c. from a single-phase mutator is of a highly undulating character. It was, therefore, considered advisable, for the sake of stable running, to use separate excitation for at least the field of machine A which is directly connected to the mutator. This precaution would have been unnecessary if a three-phase mutator had been available, and the machines would then have been arranged for self-excitation.

On a.c./d.c. mutation the machine A of the motor-generator set worked as a motor. The switch S, being connected to the left, machine B acted as generator and delivered power over the resistance R_2. In order to obtain d.c./a.c. mutation switch S, was first thrown over to the 10-V a.c. supply, when the set floated on the two systems; by adjusting the fields and cutting out resistance R_2 completely, machine B was made to assume motor and machine A generator duties.

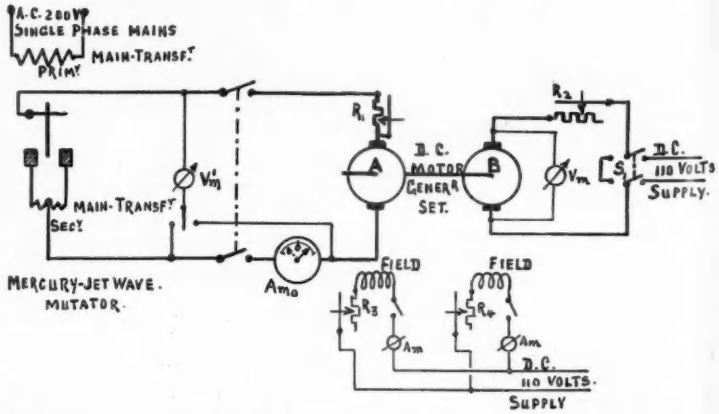
Immediately the voltage of generator A exceeded the d.c. voltage from the mutator (measured by the voltmeter V'_m) the current reversed and the mercury-jet wave acted as d.c./a.c. mutator, returning power to the 200-V a.c. mains. The current reversal was shown by the centre-zero ammeter A_{mo}, so that the deflection of this instrument, whether to the right or left, provided a definite indication that the mercury-jet wave was functioning as an a.c./d.c. or d.c./a.c. mutator.

The voltmeter V'_m was a moving-coil instrument. It read steadily in one direction only, thus furnishing another clear proof that the change in the function of the mercury-jet wave is associated with current and *not* voltage reversal, as is the case in all other systems; hence, for a mercury-arc mutator to pass from a.c./d.c. to d.c./a.c. mutation, three operations must be performed, namely, the voltage of the d.c. must be made relatively larger than that of the a.c. system; the setting of the grid-control apparatus must be changed by an angle equivalent to 180 electrical degrees; and the mains must be reversed.

With the mercury-jet wave mutator only *one* operation is necessary, *i.e.*, the voltage of the d.c. must be made relatively larger than that of the a.c. system. This property of the mercury-jet wave renders it very suitable for high-voltage d.c. transmission. Particularly when these transmission lines are used as ties between a.c. systems for mutual power exchange the mercury-jet wave mutator presents the superior and more elastic link.

It is well known from theory that the commutation loss of the mercury-jet wave working as d.c./a.c. mutator is smaller than that for a.c./d.c. mutation on account of the almost complete compensation of the transformer leakage reactance in the former case. This has been amply confirmed (apart from actual measurements) by the marked reduction of the commutation spark when the apparatus is mutating d.c./a.c.

Concluding, it might be mentioned that the manipulations described above to produce the desired change in the function of the mercury-jet wave mutator appertain to the laboratory tests only, and that in practice this change would occur quite automatically, depending entirely on the relative magnitudes of the voltages in one system or the other. Further, that in spite of the need to employ single-phase currents, the operation of the d.c. motor-generator set was surprisingly stable.



Simple test arrangement to demonstrate the mercury-jet wave working as a d.c./a.c. mutator

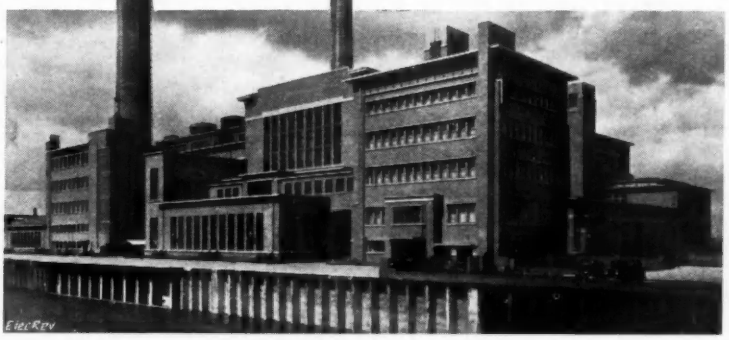
*A new nomenclature proposed by Messrs. Brown Boveri Co. has been used in this article according to which valve is designated "mutator" and rectifiers, invertors and frequency changers become "a.c./d.c., d.c./a.c. and a.c./a.c. mutators."

† See THE ELECTRICAL REVIEW, January 10th, 1936, also July 20th, 1934, and November 20th, 1933.

A New Dutch Power-house

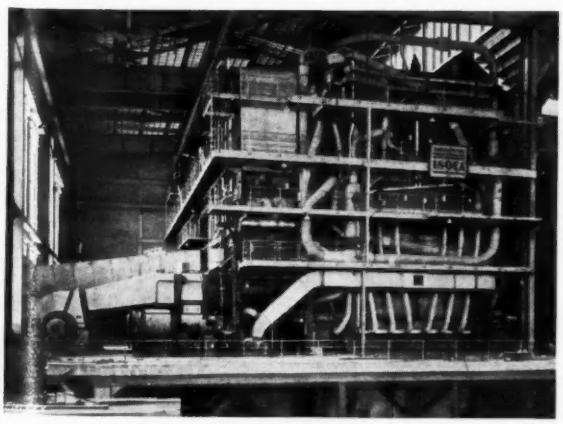
Features of the plant at Nijmegen

THE Gelderland power station recently constructed at Nijmegen, at the junction of the River Waal and the Maas-Waal Canal, has an initial plant capacity of 108,000 kW, while the present buildings are designed for a plant capacity of 200,000 kW, and for the whole station is visualised. Supplies of coal are water-borne to the station, and there is at present storage provision for 24,000 tons, which can be distributed by travelling cranes that span the storage ground. A conveyor system feeding the boiler bunkers has a capacity of 100 tons per hour.



The power-house at Nijmegen

Each of the four boilers has a maximum continuous evaporation of 250,000 lb. per hour. The steam conditions are 565 lb./sq. in. and 842 deg. F., and the stoker-fired boilers are constructed on the Babcock & Wilcox system, with Bailey water-circulation walls for the combustion chambers. Each boiler has two forced-draught, two induced-draught and two secondary air fans, the f.d. and i.d. fans being driven by two-speed motors (f.d. 79/36 h.p. and i.d. 107/44 h.p.). Combustion is automatically controlled on the Hagan system, supplied by Messrs. James Gordon & Co., Ltd.



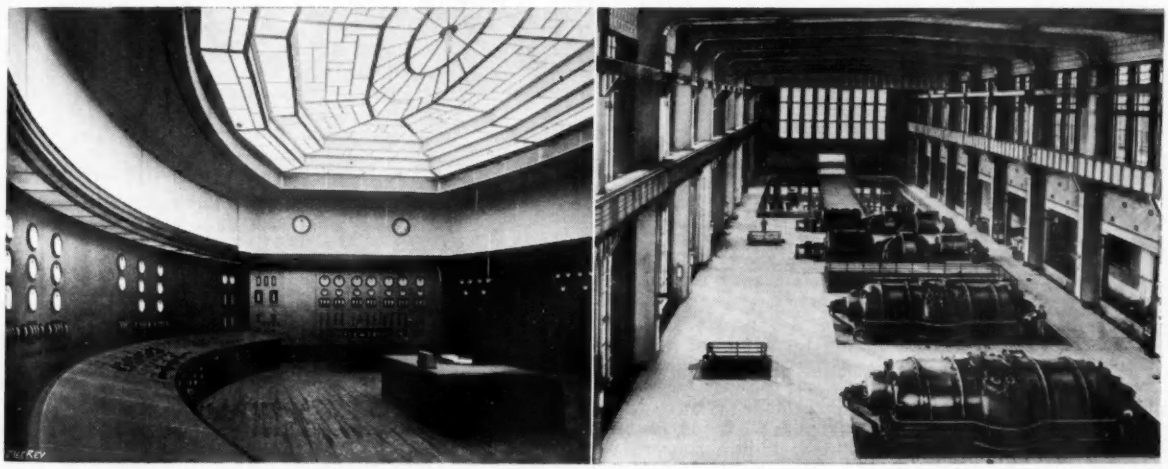
One of the boilers; forced-draught and induced-draught fans at the rear (left)

The "Hydrojet" system of ash removal is employed, 125 lb./sq. in. being the pressure of the water conveying the ash to the sump. There are four 60-h.p. vertical ash pumps, and ash and dust are conveyed through a long pipe-line to a large pump at the end of the site.

Each of the four turbo-alternators has a maximum capacity of 25,000 kW (3,000 r.p.m.) and the stop-valve conditions are 428 lb./sq. in. and 824 deg. F. There are also two 4,000-kW house sets. For feed-water preheating (condensate) two turbines are bled at two points and the other turbines at three points.

The main feed-water preheating plant is installed in a separate building between the boiler house and turbine room, in which are also housed a chemical water-cleaning installation, the main steam receivers (fitted with Hopkinson's electrically operated valves), a central condenser for drainage steam, two 10-ton-per hour evaporators, the boiler feed pumps, low-pressure steam receivers and de-aerating and cold-water tanks.

Two of the five feed pumps (Messrs. G. & J. Weir, Ltd.) have a capacity of 225,000 lb. per hour each, and three have a capacity of double that figure. The pumps have both steam-turbine and motor drives, the former serving for starting and stand-by.



Control room, and (right) generating plant

The circulating-water pumps, ash-handling pumps and screens are installed in a separate room at the river end of the turbine room. Circulating water is taken from a harbour off the canal and normally discharged into the river, but to overcome ice difficulties in very cold weather the hot water may be discharged into the harbour.

Generation is at 10.5 kV, and each alternator is directly coupled to a step-up transformer to give a transmission pressure of 50 kV from an outdoor switching station. Two of the transformers are of A.S.E.A. manufacture, and two were produced by Messrs. Siemens-Schuckert.

Gas in Electric Cookers

In the Vacation Court on August 19th Mr. Justice Bucknill had before him an application *ex parte* on behalf of the Egham and Staines Electricity Company for leave to serve notice of motion with the writ for August 26th for an interlocutory injunction against the Gas Light & Coke Company to restrain it from attaching a device to electric cookers supplied by the plaintiffs, the effect of which was to convert them into gas cookers. It was stated that the gas company had approached local consumers of electricity and obtained their consent to the fixing of gas pipes at the top of the electric cookers so that they could be used for cooking by gas. That was contrary to the contracts between the electricity company and the consumers. In reply to the Judge, counsel said when the case came on he would be in a position to say that the situation was a dangerous one, because a gas pipe might come into contact with the electric current and there might be an explosion. Mr. Justice Bucknill refused the leave asked for, observing that if counsel could satisfy him that there was any real public danger he could renew his application next week.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Fatalities in the Home

One fatality due to the misuse of electricity in the home is one too many but of recent years the number of such fatalities that have occurred is somewhat perturbing. Many householders are of the opinion that they are quite competent to do their own repairs and extensions, the latter very often being carried out by means of a few yards of rubbishy flex and unsatisfactory accessories.

Then we have hordes of adventurers who pose as electrical contractors, radio experts, plumber-electricians, &c., who are indeed more dangerous than the tampering householders. I have been connected with the electrical contracting industry for over thirty years and have no hesitation in stating that there is no other trade or profession in which so many interlopers would be tolerated. Such a state of affairs is a disgrace to the industry and there is no doubt that a great deal of the blame rests on the bona-fide electrical contractors themselves.

The National Register has certainly made an attempt to clean up the industry but I am afraid that the attempt has proved feeble so far, for the number of unqualified persons who carry out electrical installation work does not grow any smaller. In other words, anyone can carry out this class of work, whether registered or not, and in this part of the country, I am sorry to say, few are even aware that such a body as the N.R.E.I.C. exists.

At all events something will have to be done to protect tampering householders from themselves and to remove from the industry the pests to whom I have referred. In my opinion there is only one effective method of dealing with this problem, namely, the passing of an Act of Parliament to prohibit unqualified people from tampering with electrical installation work. I am, of course, claiming no originality for this suggestion which has already been tried and proved satisfactory in our Dominions and Colonies. There is no reason why we cannot achieve what others have already accomplished, if electrical contractors really wish the number of electrical accidents diminished and the industry raised to a higher plane.

Glasgow, *August 22nd.* ALEX. MILNE.

Earth-leakage Switches in Melbourne

I have read with great interest the article by "W. A. T." in your issue of August 21st, and share your contributor's misgivings as to the efficacy of the proposed method of application.

It is reasonable to expect that the idea in Australia of using the leakage trip in parallel with solid earthing was inspired by our own Regulation 1005 C, which also calls for the supplementary use of the device. This idea is faultily conceived, and many writers have pointed out that it must fail in practice. We in this country have every hope that the supplementary requirement will be removed in the near future.

Apart from the very reasonable position visualised by your contributor, in which indiscriminate operation of leakage trips may occur under certain conditions, it is clear that no selective scheme of leakage protection is possible with the method of installation proposed. I have always maintained that one of the outstanding advantages of the leakage trip is the ability to test, easily and quickly, the vulnerable earth circuit (not only from the switch itself, but from every connected piece of apparatus or socket) by simple flashing over from phase to earth; it might even be said that this attribute is of equal value to independence of a good earth connection.

With the two parallel earth paths, however, this facility is limited or absent, and a promising form of leakage protection is rendered of no greater value than the old discredited systems to which it becomes tied up.

I am glad to note, however, that Australia has adopted, almost word for word, my suggestion for the values of *voltage* operation of leakage trips as opposed to the futile current requirement in our own regulations. Here, again, we are hoping for relief in this country, and no great development of leakage trips will take place until those responsible can make up their minds as to leakage trip protection: whether it is, or is not, a stunt, or represents a real improvement in installation practice.

It is difficult, however, to understand the requirement mentioned by "W. A. T." that leakage trips should be built to break currents many times in excess of their rating, the 25-A size being required to rupture 1,200 A twice in succession. Leakage trips, as such, do not break *overload* currents, but respond to very small leakages; they are not, therefore, called upon to deal with anything more than their rated current. Presumably, there will be overload protective devices in the circuit, and it is they that require the heavy-current rupturing capacity.

The possible explanation is that leakage trips are to be combined with overload trips—another doubtful requirement—and this is borne out by the visualised cost of leakage trips, £2 to £2 10s., which is much higher than the price of the ordinary patterns.

The insulated casing and the external testing device are, of course, desirable features that have for long been advocated in this country and are gradually receiving recognition. Some of the other complications mentioned by "W. A. T." appear to have little or any value, but merely represent unnecessary expense; the leakage trip is such a simple device and the methods of installation so reasonable that it is difficult to understand the necessity for the various hampering requirements both at home and abroad.

Probably the most significant point of the whole matter is that Melbourne is abandoning multiple neutral earthing as soon as the public water mains are not available for earthing. We in this country are being urged to adopt this method of protection in country districts where water services have never existed, on the grounds that multiple neutral earthing has proved so successful in the Colonies. Possibly this further evidence will enable us to think again before committing ourselves to this very doubtful system, as regards consumer protection, although it may have advantages from the distribution point of view. T. C. GILBERT, A.M.I.E.E.

Folkestone, *August 22nd.*

Penalising the Industrial User

Referring to Mr. J. N. Waite's letter in your issue of August 14th, it would be interesting to know the cost per kWh in the Hull area as applied to the private house cited by Mr. Strode and also to the factory having a maximum demand of 600 kW with an annual consumption of 1,300,000 kWh.

It would also be interesting to know, for comparative purposes, the net rateable value of the private house which is mentioned. WATCH.

August 20th.

It is unfortunate that when you publish a useful but controversial article objection should be taken and Mr. Waite seems to prefer a censorship. While the effect of diversity is well known, I do not think that a particular set of figures regarding one batch of partially electrified houses settles the whole question.

An examination of these figures shows that (1) there is no specific allocation for management costs (the average for Hull is about 16s. p.a. per consumer) which, if applied, appears to convert the favourable balance into a loss, presumably carried by the power consumers; (2) the capital cost of distribution per consumer, after allowing a proportion for the high-voltage system, is £25, while the national average is £45; (3) though the undertaking is lucky with its rates, no allowance for these, nor for the change of frequency levy, appears to have been made.

It also appears that Mr. Waite still considers that costs should be based on the consumer's demand at the time of the system peak, though impartial writers such as Hills, Knight and Greene have demonstrated the fallacies of this method. Furthermore, the Central Electricity Board cannot consider it correct, otherwise we should all be fitted with some form of recording device for ascertaining the load curve at each bulk supply point. Obviously, the peak-responsibility method favours the later consumers who happen to have their demands at times different from the original consumers. Had cooking and heating been the original load at Hull, would Mr. Waite have considered the power load as "off-peak"?

With the present type of development at Hull, where the power and traction load is about 2½ times as large as the domestic and lighting load, it is simple to sell electricity for cooking, &c., at less than the true cost and to let the power and relatively higher-priced lighting units carry the kilowatt charges, but when the maximum demand is at about 8 a.m. (as will happen when the full developments indicated by Sir John Snell are reached) a more correct method of charging will have to be introduced.

While there may be some justification for selling *controlled* off-peak supplies at prime-cost rates (thus giving them the whole of the financial benefit due to diversity) there is none for doing the same with uncontrolled off-peak supplies such as domestic cooking. Unless such domestic supplies carry both their fair share of management costs and at the same time part of the kilowatt charge, and thus help to reduce the price

charged to the consumers already connected, there seems very little doubt that the domestic consumer is being subsidised by the power and other consumers who are so unfortunate as to have their demands at the time of the supply undertaking's peak.

R. B. ROWSON.

London, S.W.4, *August 22nd.*

The ever-recurring controversy as to whether one class of consumer is being overcharged to enable another to be subsidised is again being ventilated in your columns.

It so happens that I have been collecting some data to illustrate the principle of the contentions set forth in the leading article in your issue of April 17th, in which you contend that the power and domestic loads "are of parallel, and not divergent, interest." My data discloses some very interesting evidence regarding the alleged penalisation of power consumers to enable domestic consumers to be subsidised.

If we select a number of undertakings where the industrial load preponderates, another group where the industrial and domestic loads are approximately equal, and a further group where the domestic load forms the greater portion of the whole, then an examination of the other relevant figures appertaining to these undertakings should allow some conclusions to be drawn.

Undertaking.	% Total output sold for lighting, heating and cooking.	Average price obtained: lighting, heating and cooking.	Average price obtained: power.	Total working costs.	Load factor.	
Group A 1	14.9	3.04	0.69	0.36	34.9	Power load preponderates.
" 2	10.8	2.77	0.59	0.37	31.9	
" 3	15.0	2.28	0.66	0.68	30.2	
" 4	16.0	1.73	0.63	0.56	30.0	
" 5	13.0	2.54	0.56	0.38	29.4	
Group B 6	48.0	1.87	0.60	0.45	32.8	Two loads approximately equal.
" 7	49.0	1.33	0.70	0.53	29.5	
" 8	58.0	1.73	0.88	0.64	32.3	
" 9	40.0	2.32	0.84	0.54	28.2	
" 10	48.0	1.74	0.83	0.47	32.4	
Group C 11	83.0	2.85	1.38	1.47	25.2	Lighting, heating and cooking preponderates.
" 12	89.0	1.60	0.60	1.01	25.4	
" 13	82.0	1.77	1.30	0.89	30.1	
" 14	75.0	2.46	1.16	0.86	34.1	
" 15	65.0	2.23	1.33	0.69	34.1	

The following may be deemed to be fair and reasonable deductions from the figures set out in the table.

(1) A fully exploited domestic load field can produce a load factor equal to that of the ordinary industrial load.

(2) Costs per kWh will always be higher where the domestic load preponderates, because of the comparatively small consumption per consumer and per premises connected.

(3) The variations in the average prices obtained for lighting and domestic supply are common to each group of undertakings and reflects the degree of development of the domestic load in each individual undertaking.

(4) The comparatively high cost of power in the group C undertakings is due to the almost complete absence of consumers taking large blocks of power, and it is probable that the average power consumer uses very little more electricity than the domestic consumer.

It may be contended that it is unwise to draw conclusions from the statistics of a small number of undertakings, but I have available figures for all the undertakings selling more than 10,000,000 kWh per annum, and the features displayed in the table are equally observable when studying the statistics of all undertakings.

F. J. ELLIOTT.

Wolverhampton, *August 21st.*

The Meters Act

In the columns of your journal there have appeared a number of authoritative articles dealing with the new conditions for the testing and certification of meters as required by the Electricity Supply (Meters) Act, 1936. It is a matter of more than academic interest to know of the conditions elsewhere, and the practice in the New York State could be taken as typical of the attitude of the United States Legislature.

The American Public Service Commission is empowered to appoint inspectors of meters, whose duty it is, when required by the Commission, to inspect, examine, and ascertain the accuracy of any and all electric meters used or intended to be used for measuring current furnished for light, heat or power by any person, local authority, or company. These powers, it will be seen, are similar to those contained in the 1899 Act, Sec. 35, detailing the powers of a local authority or the Electricity Commissioners for the appointment of inspectors. A further provision is to the effect that the inspector must examine and ascertain the accuracy of all testing apparatus.

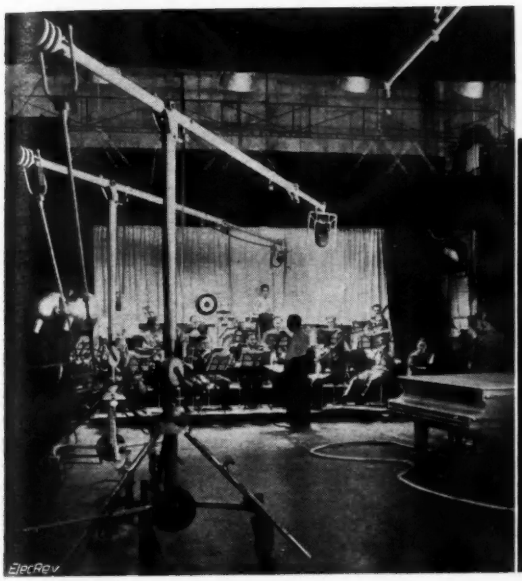
An authorised undertaker is not allowed to put into use, or to furnish to a consumer, a meter of a type which has not been approved by the Commission. This is identical with the powers of the Electricity Commissioners in this country and the obligations upon authorised undertakers.

In the matter of disputes, so prominent in this country of late, it is provided that if a consumer to whom a meter has been furnished shall request the Commission to inspect the meter, the Commission must inspect and test it. If the meter is more than 4 per cent. in error to the prejudice of the consumer, the expense of the inspection, &c., has to be borne by the local authority or company. If, however, the meter register is within this limit, the cost of testing has to be borne by the consumer. Comparison should here be made with the provisions of the 1909 Sched. 2 and 1899 Sec. 57 enactments. It should also be noted that the testing of meters in the case of a dispute is taken out of the hands of the authorised undertaker.

When he finds the meters correct, the inspector has to stamp or mark them and the testing apparatus with a suitable device. This device has to be recorded at the office of the Secretary of State. Each authorised undertaking must provide, repair, and maintain such suitable apparatus and facilities as may be required and approved by the Commission for testing and proving the accuracy of its meters.

It will therefore be seen that supervision of meter-testing equipment is provided by the law. The approval of the type of meter is similar to the general approval by the Electricity Commissioners always required in this country. But the main provisions still appear to be permissive, as in our 1899 Act, Sec. 35; *i.e.*, the Commission is empowered to appoint inspectors, but is not under any general compulsion to do so, unless a dispute arises. No cases have yet arisen of the type of Joseph *v.* East Ham Corporation, but it is probable that eventually some perspicacious person will challenge the legality of the meters in use, as has been done here.

Hull, *August 22nd.* G. V. HARRAP, A.Am.I.E.E.



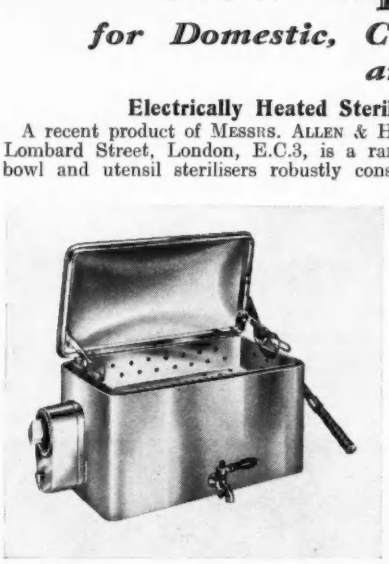
"Televising" in progress at Alexandra Palace: The left-hand picture shows the Marconi-E.M.I. studio with the instantaneous television camera (seen on the right) transmitting the action of an orchestra. On the right a scene is being televised in the Baird studio. **(See page 271)**

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electrically Heated Sterilisers

A recent product of MESSRS. ALLEN & HANBURYS, LTD., 37, Lombard Street, London, E.C.3, is a range of instrument, bowl and utensil sterilisers robustly constructed of "Staybrite" stainless steel and welded throughout. The lids are domed and have very strong hinges, heat resisting handles and stops to prevent the lid falling back. Perforated sheet-metal trays are supplied for instrument sterilisation, and strong galvanised wire trays for utensils. There is a ¼in. filling valve and the drain can be fitted with either a ¾in. angle valve or a tap. Each heater is controlled by its own three-heat switch and low-water cut-out, the latter being operated by the difference in expansion between an Invar rod placed in the top of one of the tinned copper heater blades and the blade itself, operating a spring switch which must be reset by hand when the heater has cooled. "Gee-Gee" elements are fitted.



An Allen & Hanbury steriliser

An Electric Toaster

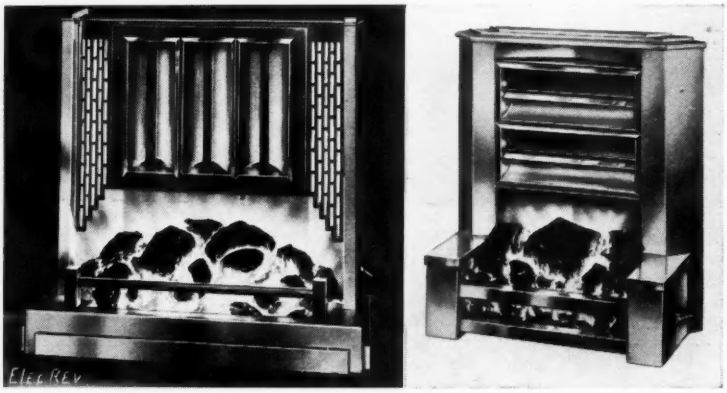
To an already extensive range of small domestic appliances, MESSRS. S. GUITERMAN & CO., LTD., 35, Aldermanbury, London, E.C.2, have added a new toaster, the No. 505. It is slightly smaller than the No. 504 and is square in shape, having a "modernistic" appearance. The doors are chromium-plated and springless. Nichrome and mica are used for the element, which is loaded at 450 W.

The "Handyhot" No. 505 toaster

Next Season's Electric Fires

Notable additions are to be made to the already extensive range of "Magicoal Plus" fires in the coming autumn by Messrs. BERRY'S ELECTRIC, LTD., Touchbutton House, 85-86, Newman St., London, W.1. One of these, to be called the "Annberry," is a low-priced model, loaded at 2 kW, in which the kind of reflector heater shown in the illustration is combined with the well-known flicker fire. It can be supplied in matt-silver or matt-copper-bronze finish with rustless bars, hobs and reflectors, or in special finishes to order. Principal dimensions are: width, 20½ in.; height, 22½ in.; depth, 8½ in. The weight is 22 lb.

Another attractive newcomer is the "Solaberry," which will be available in 2-kW and 3-kW loadings. This again combines a reflector with the "Magicoal" effect. A new feature embodied in it enables the heat from the back of the reflectors to be projected forward into the room by convection currents and through the grilles at the sides can be seen what appears to be a gradually fading flame-like glow. In the 2-kW size, which measures 23¾ by 24¼ by 9¼ in., and weighs 34 lb., the reflector bars are horizontal and in the 3-kW size, which measures 27½ by 26¾ by 9½ in., and weighs 40 lb., they are vertical. The finishes are similar to those of the "Annberry" model.



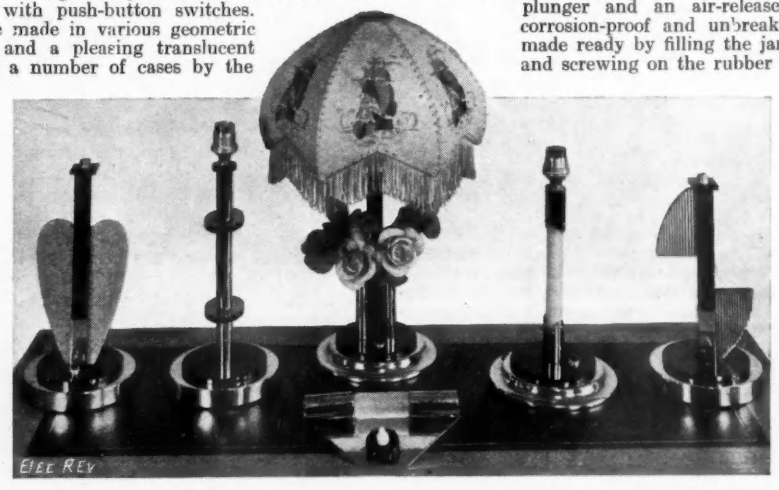
The "Solaberry" and "Annberry" fires

Novel Table Standards

A combination of chromium plate and "Erinoid" or wood is used very effectively in a large number of ultra-modern table lighting standards just introduced by MESSRS. FITZGIBBON & MURRAY, LTD., 13, Greek Street, Soho Square, London, W.1. Chromium is generally used for the bases, which can all be supplied with push-button switches. The centre stems are made in various geometric shapes and designs, and a pleasing translucent effect is produced in a number of cases by the light passing through the top of the "Erinoid."

Two particularly attractive designs incorporate glass holders for flowers; one is quite plain, while the other follows the Venetian vase design in crystal resin. The range of colours is wide, and lampshades, although not manufactured or supplied by the company, are obtainable to match.

As a development of the "Jeani" chromium-plated miniature striplight fitting for bed-heads, shaving mirrors, wardrobes, show-cases, &c., a clip-on model is available incorporating a push-switch.



A selection of new lighting standards; the "Jeani" miniature striplight fitting is to be seen in front

Automatic Battery Topping

An automatic device for filling and topping up batteries has been put on the market by MESSRS. J. F. SYKES, Warwick Road, St. Annes-on-Sea, Lancs. Known as the "E-Z," it is intended for use in conjunction with a pint, quart or half-gallon jar, and consists of a rubber cap, a spring-loaded plunger and an air-release passage, all being corrosion-proof and unbreakable. The device is made ready by filling the jar with distilled water and screwing on the rubber cap. When inverted water does not flow until the plunger is raised. To fill or top up a battery, the plunger is inserted in the vent plug-hole, allowing it to rest lightly on top of the plates. Bubbles will then rise in the jar, indicating that water is flowing. As soon as bubbles cease the filler has to be removed, for this indicates that the cell is full to the correct level of ½ in. above the plates, thus sealing the air release and arresting the flow.

The 1936-37 Lamp Publicity

Sales aids for the new season

DETAILS received from several leading lamp manufacturers indicate that their advertising schemes for the coming season will be designed to link up in some way or other with the E.D.A.-E.L.M.A. "Better Light—Better Sight Campaign," preliminary details of which have already appeared in the ELECTRICAL REVIEW.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has, for instance, introduced a "Cosmos" character known as the "Man of Vision," who is not only the possessor of good eyesight due to the use of efficient lighting, but realises, by his mental vision, the benefits derived from fitting good lamps. This figure, lighted from below by flashing lamps with illuminated letters beneath and translucent pillars at the sides, provides an attractive centre-piece, 3 ft. high by 2ft. wide, which is suitable for any sized window. A small display with a bright silver background features "Metrovick" type "B" lamps.

Electric signs, folding units, carton containers, booklet holders, showcards, calendars, are other "Cosmos" sales aids, and among catalogues is a handy publication (S.P.7102/8) with a thumb index and loop for hanging, which covers the whole range of "Cosmos" lamps except Metrovick electric discharge lamps, which are dealt with in a separate list (S.P.7102/16). The "Men of Vision" booklet (S.P.7102/14) for children describes the achievements of famous men noted for their eyesight. The envelope series booklet (E.S.4102/17), containing prices and information on planning good lighting, and the envelope series folder (E.S.4102/13) dealing with "Shrine" and "Remembrance" lamps are both supplied overprinted.

To encourage the use of more and bigger "Mazda" lamps the BRITISH THOMSON-HOUSTON CO., LTD., has prepared a window display, the front portion of which bears illuminated portraits contrasting the effect of adequate and inadequate lighting on a child's eyesight. In addition to the "Better Light—Better Sight" slogan, it has the appropriate phrase "Protect her sight with Mazda light," with side panels showing the company's complete range of coiled-coil pearl lamps. To link up with this display is a 20 in. by 15 in. showcard bearing a coloured portrait of a child doing her homework. Another showcard is available for "Mazda" automobile bulbs. An entirely new item, which is suitable for counter displays or for ceiling suspension, is a folding box sign, strongly made of metal and wood, with the words "Use Mazda light."

The "Mazda" catalogue is more comprehensive than ever, and contains fifty pages, conveniently thumb indexed. An attractive colour spread is devoted entirely to decoration lights, including the "Mickey Mouse," "Bell-Star" and fairy lights. Light tubes are prominently illustrated in full colour, and interesting new items are the B.T.H. type "D" holder and the special wood and metal mounts. In the well-known "Lamp Business Guide" prices of all "Mazda" lamps are given, together with dimensioned outlines of bulbs and a useful table of discounts. Other "Mazda" publications, which can be supplied overprinted, comprise a compact folder (L.619) containing condensed information of every type of lamp, a separate price list (L.621) of automobile lamps, and a small card (L.623) giving particulars of B.T.H. type "B" pearl lamps.

The showcards and display materials prepared by the electric lamp manufacturers for the forthcoming lighting season are more than usually attractive

A strong trade Press advertising programme will be supplemented by CRYSELCO, LTD., by much attractive publicity material for use by the retailers. Brightly coloured window displays, supplied complete, this year give Col. Chris Elco a companion in the form of a lovely maiden and point out that "there is beauty in good light." Provision is made for illuminating them by means of a single lamp at the back. A neat cut-out shows "Col. Chris Elco of the Light Brigade" mounting guard by a gateway supporting a coiled-coil opal lamp.

Complete price lists are printed on the back of both the general lamp showcard and that for automobile bulbs, the latter informing prospective customers that "they can see at a glance with Cryselco lamps." Well-illustrated catalogues and lists can be supplied overprinted. Particulars of special decoration outfits and colour-sprayed decoration lamps for the Coronation will be available shortly.

"Be kind to your eyes and your purse" is the exhortation given by the BRITANNIA ELECTRIC LAMP WORKS (1934), LTD., in its window display, which can be illuminated by a lamp inserted at the back. Attraction will be drawn to the well-known "Night-a-light" by a show stand depicting a mother holding her baby. A window bill bears the striking slogan, "The low charge of the Light Brigade."

The Edison Swan Electric Co., Ltd., tells us that it has for some time been trying to find a substitute for ordinary crêpe paper, which is comparable both as regards price and utility, as a medium for window dressing. Although the new season's "Royal Ediswan" lamp window display is actually still composed mainly of crêpe paper, it is entirely different in appearance, creating a more solid impression, especially when used for imitation grained-wood backgrounds. The centrepiece is illuminated by one lamp, operated by a thermo-flasher, which brings into play an arrow indicating the brightly-lighted "Brighterholme." The complete window display can be professionally dressed or the centrepiece can be obtained separately.

The advantages of the coiled-coil "Ediswan" lamp are expounded in an extra large showcard measuring 20 in. by 30 in., and handy discount tables are included in the pocket edition of the larger 52-page general lamp catalogue (No. L.1075). A multi-coloured folder contains illustrations, prices and of lamps for practically all purposes.

Siemens Electric Lamps & Supplies, Ltd., are again using the National Press for their main appeal to the public, supplemented by extensive advertising in the trade journals. Among publicity materials for use of retailers an original window display is particularly effective when illuminated. The front portion consists of an attractively shaped display card in bright colours with reproductions of the company's pearl and opal lamps and cartons. Through an opening at the bottom is seen a temple of light, the fore-court of which is supported by two pillars of white marble surmounted by golden capitals. At the base of these the "Popular Pair" kiddies are depicted dancing joyously, with the caption "Light is Life."

"Big Ben" tower, floodlighted, has been retained in the new Siemens showcard, which is carried out in black and white, with the slogan "Used for lighting Big Ben and just as reliable." A brightly coloured cut-out is provided for holding price lists, which are available for overprinting. Leaflet No. 531 describes pearl, opal, clear, tubular and coiled-coil lamps, and No. 533 gives the complete range of automobile lamps.

"Measured Light" is the theme of all publicity designed by Philips Lamps, Ltd., to influence domestic and business users, while the "Safety" appeal of better lighting has been chosen for the motorists. Among new window displays a twilight scene is particularly effective, flashing arrangements linking up with the slogan "When twilight falls, Philips lamps for daylight brilliance. The "Shopping" display shows a table with various purchases, including Philips lamps in front complete with flex and lampholder. When the light is switched on the words "Philips" and "Measured Light" are illuminated. Carton counter display leaflet holders invite the public to help themselves to a leaflet which tells them how to save their eyes and their pockets. "Measured Light" showcards, together with window transparencies, will again appear prominently in the 1936-37 campaign.

For advertising automobile lamps a window display depicting a night scene has been prepared. Another cardboard display shows a man fitting a bulb into a car head lamp, with the words "Sixty per cent. of the accidents occur at night—fit Philips motor bulbs and make night driving safe." Price lists covering all types of lamps can be supplied overprinted.

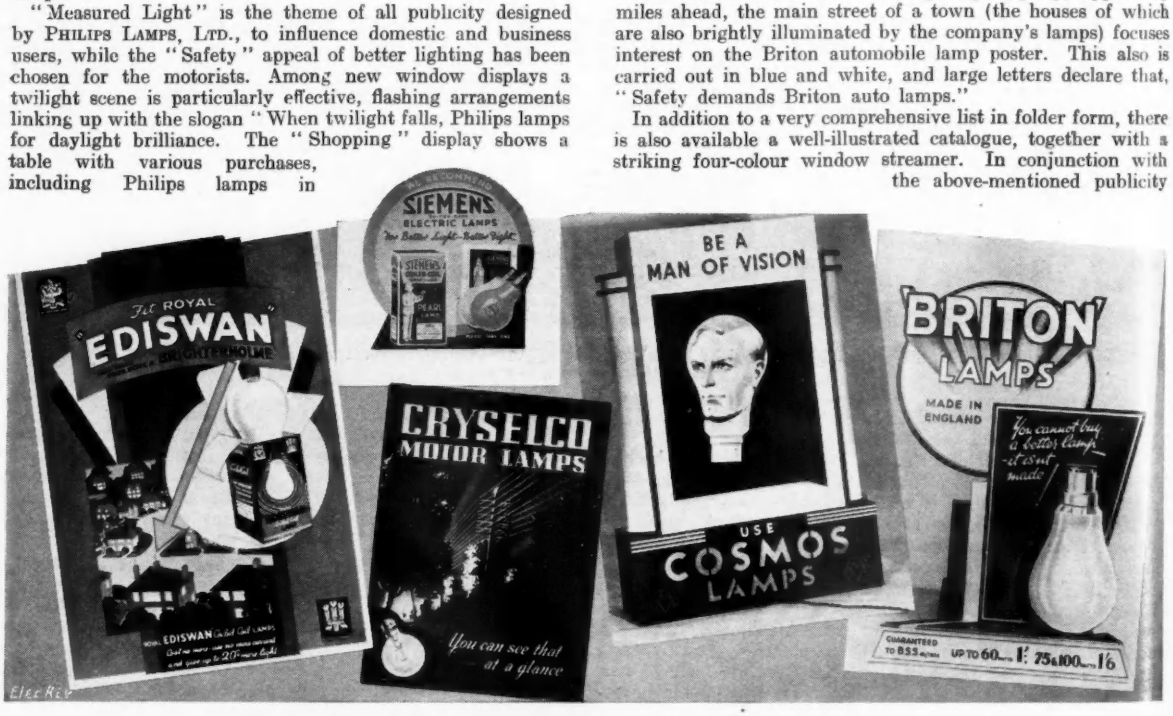
These Philips and "Mazda" display pieces will compel attention this winter

Briton Lamps, Ltd., have considerably enlarged their range of lamps, types being now available for almost all present-day requirements. Among ample supplies of show matter available is a striking blue and white poster of a village at night-time with the intimation that "Briton lamps are (or should be) in every home." For counter or window display use there is a 14 in. by 10 in. cut-out, printed in orange, black and various shades of blue, and representing a large-sized lamp accompanied by the words, "You cannot buy a better lamp—it isn't made!"

A motor car with its headlamps lighting up, apparently miles ahead, the main street of a town (the houses of which are also brightly illuminated by the company's lamps) focuses interest on the Briton automobile lamp poster. This also is carried out in blue and white, and large letters declare that, "Safety demands Briton auto lamps."

In addition to a very comprehensive list in folder form, there is also available a well-illustrated catalogue, together with a striking four-colour window streamer. In conjunction with the above-mentioned publicity materials an extensive Press advertising scheme is planned in the national and leading provincial newspapers.

Other leading lamp manufacturers are just putting the finishing touches to their publicity schemes for this autumn, and we hope to describe these in a forthcoming issue. With the wealth of display material that is available, and with the assistance of the B.D.A.-E.L.M.A. campaign, retailers will have no excuses for not making the 1936-37 lamp season even more successful than its predecessors.



A further selection of lamp publicity matter available for dealers

illuminated cartons. A house with a revolving cylinder behind, lighting up windows alternately, is the centrepiece of a "Better Lighting" scheme, while a 40 in. by 25 in. cardboard display links up with the theme of the season's campaign, "There's a difference in the light you get, there's a difference in the bill you pay."

Cardboard floor stand "merchandisers," which can be used either on the floor of the shop for displaying cartons of lamps or as a small window display, are fitted with a transparency

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

National Association of Radio Retailers

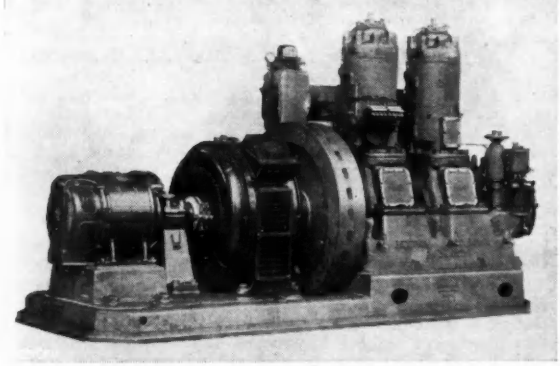
As already stated here (ELECTRICAL REVIEW, August 14th, p. 202) N.E.C.T.A., Ltd., is completing formalities with regard to the formation of the National Association of Radio Retailers. It hopes in the course of the next week or so to announce that the organisation has been duly registered by the Board of Trade. A complete announcement has been delayed owing to the necessity of producing a Memorandum of Association and Articles before a formal Registration Certificate can be obtained. We are, however, able to state that the association proposes to cater for the interests of all genuine radio retailers, whether or not their radio business is run in conjunction with any other business. The term "genuine," used as a qualification, means that the retailer must be genuinely in the trade from a commercial and financial point of view, and that he must be able to provide the sales and service which the public has every right to expect from a modern well-organised industry. The annual subscription for the first year of operation is £2 2s., with an entrance fee of £3 3s., but the entrance fee will be waived for all who have submitted a bona fide application within six months from the date of registration. Pending the circulation of particulars with forms of application for membership genuine radio retailers who are interested in the proposed association are invited to communicate with the N.E.C.T.A., Ltd., 23, Bedford Square, London, W.C.1, so that full information may be forwarded as soon as it is available.

Employment in July

Employment generally in the engineering industry during July was fairly good, and although there was a seasonal slackness in some sections in electrical engineering it was still good. The *Ministry of Labour Gazette* states that the total out of work in the engineering industry as a whole was 78,110, showing no appreciable change as compared with the preceding month, but a fall of 37,746 as compared with July, 1935. The percentage of 7.9 compares with 11.8 in July last year. In the electrical engineering section the number of unemployed was 3,784, or 4.1 per cent., which compares with 4.3 per cent. in June and 6.1 per cent. in July, 1935. The unemployed in the electrical wiring and contracting industry numbered 5,014, the proportion rising from 12.8 per cent. to 14.2 per cent. (12.9 per cent. in July, 1935). In the electric cable apparatus and lamps, &c., group the number of unemployed was 8,736, the percentage falling from 7.1 to 6.1 (7.3 in July, 1935).

Diesel Engines on a Rubber Plantation

More than ninety per cent. of the world's rubber now comes from plantations, which have almost superseded Para as a source. Those of the Firestone Plantations Co. in Liberia are situated near Cape Palmas in Maryland County, where 65,000 acres are planted, of which 12,000 acres are already producing



A Petter atomic Diesel engine installed at Firestone Plantation

latex. After being collected the latex undergoes preliminary manufacturing processes at the factory before shipment. Installed in the factory power station are three twin-cylinder atomic 109-b.h.p. Diesel engines of the two-stroke cycle, airless-injection type made by Petters, Ltd. These are directly coupled to 60-kW, 220-V alternators of Lancashire Dynamo & Crypto Co. manufacture. Each unit is mounted on a fabricated-steel bedplate. At the left-hand side of the exhaust manifold is an integral "streamline" lubricating oil renovator. The engines are started by compressed air from receivers charged by a small compressor driven by a petrol-paraffin engine, and cooling water pumped from the river flows by gravity through the engine cylinders from an overhead tank. Part of the energy generated is stepped up and distributed throughout the plantations over approximately forty miles of transmission line for operating an ice plant, several water pumps, and for lighting the houses occupied by the staff of nearly one hundred Europeans. The larger part of the output is used for power in the factory and garage. In the former a battery of centrifuges removes water from the latex, bringing it to a uniform rubber content of 60 per cent. The skim is coagulated in pans and passed through mechanical washers and mills, the latter pressing the rubber into long sheets. The garage is equipped with lathes, grinders, planers and other equipment to handle the sixty cars and trucks in use on the plantations. Communication between the plantations and the company's head offices is maintained by means of radio, power for the transmitting and receiving instruments being supplied by a Petter semi-Diesel generating set. Similar generating plant to the main plantation sets has been installed in Monrovia by the Government of Liberia for generating electricity to light the streets of the capital and for domestice service; an additional set is now being supplied to meet the increasing load.

The Housewife's Dream

The accompanying illustration shows an exhibit entered by the Harrogate Corporation Electricity Department on the occasion of the Knaresborough Carnival. As will be seen,

The display entered by the Harrogate Electricity Department in the Knaresborough Carnival

it was headed by a lorry with a display of small appliances, and was entitled "The Housewife's Dream." Following this was a train of large-scale models of electrical domestic appliances. In sending us the photograph, Mr. N. McLean, the borough electrical engineer, informs us that the apparatus was lent by Mr. Newey, of Lincoln, and the display was awarded second prize.

British Electrical Experts in Barcelona

The paragraph published under this title in our last issue (p. 258) calls for correction. We learn from Mr. E. A. Reid, manager of the Purchasing and Shipping Department of the Canadian and General Finance Co., Ltd., who are the purchasing agents in London for the Ebro Irrigation and Power Co., Ltd., that Mr. Fraser Lawton is the president of the Ebro company (Riegos y Fuerza del Ebro S.A.), subsidiary of the Barcelona Traction Light and Power Co., Ltd., and the operating company in Spain. Mr. Fraser Lawton, as stated by our correspondent last week, is remaining in Spain in control of the enterprises, subject to Government intervention, but Mr. Reid informs us that it is not the fact that all the British and Canadian staff have returned to England, for at least ten of the important English and Canadian members of the staff are still in Spain, loyally supporting Mr. Lawton in the present serious and difficult situation. Further, the staff in Barcelona are not entirely quartered in the Club Maritima, for Mr. Lawton and some of them are residing in various parts of the city.

Industrial Court Decisions

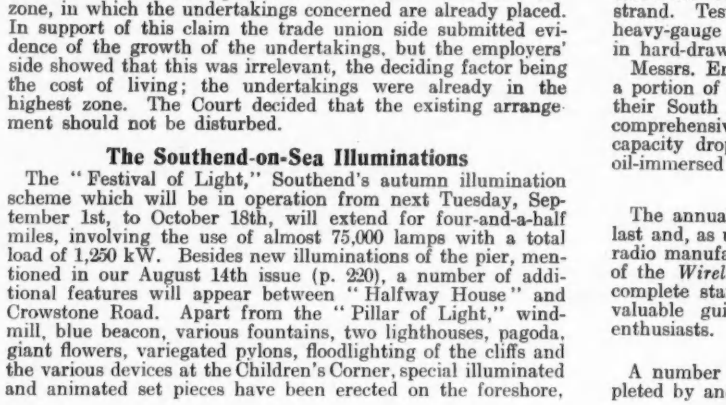
The Industrial Court has recently given two decisions upon matters submitted by the National Joint Industrial Council for the Electricity Supply Industry, both emanating from the No. 11 District (Sussex, Hampshire and Dorset). The first was a claim by the trade union side for the payment of double time for Good Friday and Christmas Day and time-and-a-half for bank holidays or nationally proclaimed holidays where these days fell into a shift-worker's normal shift. It was asked that this provision should apply to all shift workers, including switchboard and sub-station attendants and their assistants. At present the schedule of wages and working conditions provides for the payment of time-and-a-half for Good Friday and Christmas Day, but makes no allowance for bank holidays. In support of the claim it was submitted that day workers were already in receipt of the rates claimed for shift workers

and that there had also been improvements in their conditions which shift workers had not shared. The employers' side, in opposing the claim, pointed out that, so far as switchboard and sub-station attendants were concerned, the change would be at variance with the provisions of the National Agreement. It was also stated that the rates paid in District No. 11 compared favourably with those paid in the other districts. The Court decided that the grounds upon which the claim was based were not such as to warrant the changes involved.

The second claim was for the creation of a special zone to cover Brighton, Portsmouth and Southampton, the wage rates for which would be 5 per cent. above those fixed for "A" zone, in which the undertakings concerned are already placed. In support of this claim the trade union side submitted evidence of the growth of the undertakings, but the employers' side showed that this was irrelevant, the deciding factor being the cost of living; the undertakings were already in the highest zone. The Court decided that the existing arrangement should not be disturbed.

The Southend-on-Sea Illuminations

The "Festival of Light," Southend's autumn illumination scheme which will be in operation from next Tuesday, September 1st, to October 18th, will extend for four-and-a-half miles, involving the use of almost 75,000 lamps with a total load of 1,250 kW. Besides new illuminations of the pier, mentioned in our August 14th issue (p. 220), a number of additional features will appear between "Halfway House" and Crowstone Road. Apart from the "Pillar of Light," windmill, blue beacon, various fountains, two lighthouses, pagoda, giant flowers, variegated pylons, floodlighting of the cliffs and the various devices at the Children's Corner, special illuminated and animated set pieces have been erected on the foreshore, including a volcano in eruption, a gondola, St. George and the Dragon, a sea horse, a pirate boat and a sea monster. To attract the children the shrubbery has again received special attention and the following have been added to last year's features of the "Never Never Land":—A vine bower, a pigmy village, "Crazy Town," and "Sloppydorus." A handsome souvenir brochure containing a number of coloured plates of the illuminations has been produced by the Corporation Electricity Department (engineer and manager, Mr. A. C. Johnson). The opening ceremony on Tuesday will be performed by the Mayor, Councillor A. M. White, J.P.



A 750 b.h.p., "L" type English Electric Diesel engine leaving the company's Rugby works en route for the Pinewood Studios

A.c. Electric Motors and Control Gear

Under the above title, Brook Motors, Ltd., has published a handbook (size 3¼ in. by 4¾ in., blue limp cover, price 1s.), the information in which mainly concerns users of the company's equipment; there is, however, a good deal of matter on service for all motor installations. The contents include numerous connection diagrams, constructional and operating details of motors, information regarding wiring, control gear, h.p. required to drive various machines, extract from B.S.S. 168-1926 dealing with performance of industrial electric motors with Class A insulation, and buildings regulations. A section at the end gives details of supply in various districts.

The Empire Exhibition at Johannesburg

Messrs. Thomas Bolton & Sons, Ltd., are exhibiting a comprehensive display of their products on the stand of Messrs. Hubert Davies & Co., Ltd., their South African agents, at the Empire Exhibition opening in Johannesburg next month. Their exhibits will include a large number of copper and brass tubes, forged and machined parts, such as copper rail bonds, cable clamps and terminals, nuts, bolts and washers, phosphor bronze high tensile bolts and nuts and other components, "M" alloy (Bolton patent) high tensile forged and machined components, manganese bronze high tensile machined components, and a typical shell driving band of cupro-nickel. A large number of extruded and drawn sections in both copper and brass will be shown. These sections, which have many electrical uses, vary in shape from the simple and symmetrical to the very complex. Copper wire, both plain and tinned, will be shown in sizes down to 0.0014 in. diameter, and heavy-gauge copper and cadmium copper contact wire (for electric tramways and railways) in a number of sizes and sections. A variety of copper strands will also be displayed. The Bolton patent cellular conductor for high-voltage transmission lines and bus-bars, which has as its object the reduction of corona discharge losses, will be represented in a number of sizes, and there will be samples of brass wire and hemp-cored bronze strand. Test pieces, showing the twist test for ductility in heavy-gauge contact wire and the wrapping test for ductility in hard-drawn wire, are included in the display.

Messrs. Erskine, Heap & Co., Ltd., are also exhibiting on a portion of the stand of Messrs. Hubert Davies & Co., Ltd., their South African agents, and the display will include a comprehensive range from high-voltage, heavy rupturing capacity drop-down units to low-voltage industrial gear and oil-immersed and air-break starters.

Radio Progress

The annual Radio Show at Olympia opened on Wednesday last and, as usual, the most up-to-date achievements of British radio manufacturers are exemplified there. A special number of the *Wireless World* published to-day (Friday) contains a complete stand-to-stand survey of the show, thus forming a valuable guide to the equipment now available to radio enthusiasts.

Orders Recently Booked

A number of important contracts have recently been completed by and new contracts awarded to the English Electric Co., Ltd., for marine work and for Diesel generating plant for land purposes. The new Diesel-electric chain-driven ferry built by Messrs. J. Samuel White for the cross-river service between East and West Cowes on the River Medina, Isle of Wight, was placed in service on August 25th, having satisfactorily completed her dock trials. The English Electric Co. supplied the whole of the electrical equipment, an interesting feature of which is that for peak loads the main propulsion motor derives its supply from the generators in parallel with a battery. The Thames Steam Tug & Lighterage Co. has ordered a second Diesel-electric tug. This will be a duplicate of the *Framfield*, and will be equipped with two English Electric K-type, 6-cylinder engines. The hull will be constructed by Messrs. J. I. Thornycroft & Co., who built the hull of the *Framfield* and previous tugs for the same owners. The English Electric Co. also carried out at the beginning of the year the complete change-over from d.c. to a.c. of all the machinery at the works of the British Power Boat Co., Hythe. A similar contract has just been received for changing over the electrical equipment at the yard of Messrs. Camper & Nicholson, Gosport. Shipbuilding yards to which the English Electric Co. has recently supplied a.c. arc welding equipments include: The Admiralty; Camper & Nicholson, Ltd.; Blythswood Shipbuilding Co., Ltd.; Clarke, Chapman & Co., Ltd.; Lithgows, Ltd.; Smith's Dock Co., Ltd.; and Cammell Laird & Co., Ltd. The company has now received a contract from Smiths' Dock Co., Ltd., for the complete Diesel-electric propulsion machinery for a new Trinity House vessel. The equipment will comprise two English Electric "L"-type Diesel engines, together with the twin screw propulsion equipment, two 60-kW auxiliary generators and all engine room equipment. This vessel, when completed, will be one of the largest Diesel-electric propulsion equipments ever built in this country for British owners. New contracts for stationary Diesel generating plant include an order for a 1,000 b.h.p. Diesel generating set from Messrs. Henry Boot (Garden Estates), Ltd., for the Pinewood Studios. This contract follows the installation of three 750 b.h.p. and one 300 b.h.p. Diesel generating sets for the same studios, making a total of 3,550 b.h.p. An order has been received from the Sudan Light & Power Co., Ltd., for one 1,000 b.h.p. 4-cylinder Fullagar engine. This set will operate in parallel with three other Fullagar engine generating sets already installed in the same station. The British Broadcasting Corporation has ordered two 750 b.h.p. Diesel engines and alternators. These will act as standby units at the new Empire Station, Daventry; they will be identical with the four 750 b.h.p. sets which the B.B.C. has had in operation for several years at Droitwich. An order for three 350 b.h.p. Diesel-electric units has been received from the Southern Railway for Diesel-electric shunting locomotives to be built by the Railway Co.

Air Pre-heating and Industrial Plants

The efficiency of a boilerhouse depends almost entirely on the temperature at which the flue gases go up the chimney. If no economiser is installed the temperature of the gases leaving a Lancashire boiler may be from 600 to 900 deg., but an alternative method of reducing the loss is provided by heating the air for combustion. At Messrs. Lucas's factory near

Birmingham, the gases from two Lancashire boilers passed direct to the stack at over 700 deg. F. A Meldrum air heater has recently been placed outside the building and by this means the temperature of the gases has been reduced to 385 deg., the air being heated to a temperature of 320 to 400 deg., depending on the load. The gases make a double pass through the heater, vertically upwards through the tubes on one side and vertically down through those on the other, being drawn through the system by an induced-draught fan and delivered into the existing chimney base. The air is forced horizontally round the tubes, also in two passes, the air at the delivery end being adjacent to the tubes which carry the hottest gases. Air is collected from the top of the boilers at a high preliminary temperature and delivered through steel ducting to the boiler front. The boilers are fitted with Meldrum sprinkler stokers with fixed grates and secondary air is circulated through the hollow-type fronts. The coal consumed in these two boilers averaged 20 tons per day, and consisted of double screened nuts at 22s. 6d. to-day. Peas are now used at 17s. 3d. per ton, and a consumption of 16 tons per day, representing a saving of over £2,000 per annum. At the same time, the duty of the boilers has been increased.

French Electrical Imports and Exports

The French imports and exports of electrical machinery, apparatus and cognate material during the three months to March last as compared with the corresponding period of 1935 are shown in the appended table. The values are given in thousands of francs, while, for purposes of comparison, the sterling value of the totals, converted at the rate of 75 fr. to the £, is added :—

	Imports. Jan.–March.		Exports. Jan.–March.	
	1935. 1,000 fr.	1936. 1,000 fr.	1935. 1,000 fr.	1936. 1,000 fr.
Dynamo-electric machines, transformers and parts	7,251	5,472	7,061	4,801
Telegraphic, telephonic and other electrical appliances	33,254	26,918	27,387	17,978
Incandescent lamps and radio valves	11,435	8,850	3,807	3,873
Arc lamps and parts	31	46	17	—
Carbons for electrical and industrial purposes	1,572	1,341	3,148	3,466
Electric wires and cables	1,149	2,979	6,332	6,009
Parts of electrical apparatus	4,878	3,765	2,380	2,968
Magnets, other than electromagnets	123	81	—	—
Accumulators and parts	405	437	3,012	2,584
Dry batteries and condensers	5,757	2,855	679	502
Porcelain and other insulators	409	425	1,413	2,440
Total fr. (1,000)	66,264	53,169	55,236	44,621
Total at 75 fr. to the £	£883,520	£708,920	£736,480	£594,946

It will be seen that the imports underwent a decline of £174,600, or nearly 20 per cent. Of the eleven items scheduled only four showed an increase, the chief advances being in wires and cables, accumulators and insulators, while the largest decrease occurred in telegraph, telephone and other electrical apparatus and electric lamps. On the export side the shrinkage amounted to £141,534, again nearly 20 per cent.

Trade Announcement

From September 1st the London office address of Switchgear & Equipment, Ltd., will be Eagle House, 90-96, Cannon Street, E.C.4.

International Foundry Congress

Arrangements have been made for members of the Institute of Vitreous Enamellers to visit the enamelling plant of the Rhenania Vereinigte Emaillier-Werke, A.G., Schwelm, in Westphalia, during the International Foundry Congress which is being held at Dusseldorf from September 16th-21st. Travelling arrangements and hotel accommodation for attendance at this conference can be obtained on application to the secretary of the Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, and those desiring to visit the enamelling plant should advise the hon. general secretary, the Institute of Vitreous Enamellers, 49, Wellington Street, Strand, W.C.

Illumination Design Course

The Lighting Service Bureau of Scotland (E.L.M.A.) is holding an illumination design course at the Royal Technical College, Glasgow, during October and November next. The course will commence on October 1st, when Mr. T. Catten will give a lecture on "Modern Methods of Illumination Design." The remainder of the course is as follows :—October 8th : "The New Science of Seeing," by Mr. W. J. Jones. October 15th : "Modern Industrial Lighting," by Mr. J. W. Howell. October 22nd : "Electric Discharge Lamps," by Mr. L. J. Davies. October 29th : "Engineering Aspects of Architectural Lighting," by Mr. H. Lingard. November 5th : "The Retail Shoplighting Market," by Mr. T. Catten. The lectures will commence at 7.30 p.m.

Lighting in a Large Printing Works

The new printing works which have been erected at Park Royal by Messrs. Waterlow & Sons, Ltd., for the *Radio Times*, will be completed during the autumn. They have a most elaborate lighting scheme which has been designed by Holophane, Ltd., and a feature of the installation is the use of mercury discharge lamps in special diffusing glass fittings. The lighting and power installation work is in the hands of Messrs. Bell Bros., London.

National Electrical Planning

In his presidential address to the Electrical Trades Union at Scarborough on Monday last, Mr. E. W. Bussey advocated the complete nationalisation of generation, transmission and distribution of electricity. He said they had made this the basis of their case before the Government Committee on Electrical Distribution. The anarchy which existed in respect of voltages, prices and methods of charges for electricity, the impossibility of any form of standardisation in view of the varying system operating, and the difficulties of dealing with rural areas under existing methods of distribution, formed the basis of their claim that the only solution of the problem was a scheme of national planning and control. They must have the energy derived from large planning, in contrast to tinkering in small districts, if an efficient and cheap supply of electricity was to be obtained for the nation.

Wages in the Cable Making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that there will be no cost-of-living alteration in wages on the third pay day in September.

The Technical Institution Equipment Centre

The Association of Technical Institutions, the Association of Principals of Technical Institutions, and the Association of Teachers in Technical Institutions recently formed an advisory committee to encourage the setting up of a bureau and display centre for technical institution equipment. This bureau, known as the Technical Institution Equipment Centre, has been established at British Industries House, Marble Arch, W.1, and is for the free use of directors of education, members of Government bodies, principals, teachers, and all other buyers of technical institution equipment.

For Sale

An automatic electric pumping plant is offered for sale by Twickenham Borough Council

Lanark County Council has for disposal engine-driven generating sets at Hairmyron Sanatorium, East Kilbride. (See our classified advertisements.)

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price. August 26th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per cwt.	50s.	—
a Ammoniac, Sal ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... „	£18 10s.	—
a Borax ... „	£17	—
a Copper, Sulphate ... „	£15 10s.	—
a Potash, Chlorate ... per lb.	3½d. to 4½d.	—
a „ Perchlorate ... „	6d.	—
a Shellac ... per cwt.	£4 18s.	—
a Sulphur Commercial ... per ton	£11	—
a „ Roll ... „	£11	—
a Soda Chlorate ... per lb.	3¼d. to 3¾d.	—
a „ Crystals ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... per ton	£100 to £105	—
b „ Wire ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... per ton net	£172	—
Grade II ... „	£120	—
Grade III ... „	£66	—
c Brass (rolled metal 2" to 12" basis) per lb.	7¼d.	—
c „ Tubes (solid drawn) ... „	9¾d. to 10d.	—
c „ Wire, basis ... „	7¾d.	—
c Copper Tubes (solid-drawn) ... „	10¼d.	—
g „ Bars (best selected) ... per ton	£70	—
g „ Sheet ... „		
g „ Rod ... „		
d „ (Electrolytic) Bars ... „	£43	—
d „ „ Wire Rods ... „	£48 10s.	—
d „ „ H.C. Wire ... per lb.	7⅛d.	—
f Ebonite Rod ... „	1/6 to 2/– plus	—
f „ Sheet ... „	1/3 to 1/6 10%	—
n German Silver Wire ... „	2/5	—
h Gutta-percha, fine ... „	nom.	—
h India-rubber, Para-fine ... „	10¼d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	67/6	—
i „ Wire galv. No. 1, P.O. Qual. ... „	£20	—
g Lead, English Pig ... „	£19	5s. inc.
g Mercury ... per bot.	£11 15s. to £12 5s.	—
c Mica (in original cases) small ... per lb.	9d. to 1/6	—
c „ „ „ medium ... „	5/– to 10/–	—
c „ „ „ large ... „	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/1	—
p „ „ drawn bars & rods „	11¾d.	—
p „ „ rolled strip & sheet „	11¼d.	—
p „ „ wire ... „	1/0¾d.	—
o Platinum ... per oz.	£10 10s.	£2 inc.
d Silicium Bronze Wire ... per lb.	8⅛d.	—
g Spelter ... per ton	£13 8s. 9d.	1s. 3d. inc.
r Steel, Magnet, in bars ... per lb.	7½d.	—
g Tin, Block (English) ... per ton	£183	£2 5s. dec.
n „ Wire, Nos. 1 to 16 ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

Oerlikon, Ltd., Victoria House, Southampton Row, London, W.C.1.—Two bulletins dealing with mercury rectifiers and the generators at Dixence power station.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—Booklet No. 1246 dealing with industrial process ventilation.

English Electric Co., Ltd., Stafford.—New catalogues of fires, neon sign transformers, multi-cylinder impulse-reaction steam turbines, fractional h.p. motors, and distribution boards.

Kolster-Brandes, Ltd., Cray Works, Sidcup.—A catalogue of the new season's radio sets.

Vaughan Crane Co., Ltd., Openshaw.—A pamphlet dealing with pulley blocks.

Sloan Electrical Co., Ltd., 54/55, Fetter Lane, London, E.C.4.—A catalogue (pp. 31) of lighting fittings.

Bruce Peebles & Co., Ltd., Edinburgh, 5.—A leaflet describing steel-clad six-ten type a.c. motors.

Crofts (Engineers), Ltd., Thornbury, Bradford.—Details of V-rope variable-speed pulleys.

British Insulated Cables, Ltd., Prescot.—A slide-rule for the calculation of power factor has been produced in the form of a booklet. Also catalogues of house service a.c. energy meters and a.c. prepayment meters.

Direct Electric Lamp Co., Ltd., 80, City Road, London, W.C.1.—A wholesale catalogue of lamps, fires, clocks and various domestic electrical goods.

Graham Farish, Ltd., Masons Hill, Bromley.—Leaflets dealing with the "Aeroficient" fan and the "Parabolic" fire.

Wall Plug Co., Ltd., 14, Bardwell Street, London, N.7.—Details of the "Plug-it" wall plug and drill.

Revo Electric Co., Ltd., Tipton, Staffs.—A catalogue of the new season's fires.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, 16.—A folder dealing with switchgear at the Liverpool Pumpfields sub-station.

Bankruptcy Proceedings

S. J. Miles, 134, Queen Victoria Road, Coventry, radio and electrical engineer.—This debtor filed his own petition, and he has now prepared a statement of affairs which shows gross liabilities of £1,387, of which £1,358 is expected to rank for dividend, with net assets of £178, leaving a deficiency of £1,180. The debtor has been aware of his position since October, 1933, and he attributes his failure to bad debts, heavy overhead expenses, and depreciation of second-hand stock taken in part exchange for new sets.

J. Freeman (Albion Electric Co.), manufacturer of electrical appliances, Albion Works, Lampeter Street, N.1.—Receiving order made August 17th on a creditor's petition. First meeting August 31st and public examination November 18th, both at Bankruptcy Buildings, Carey Street, W.C.

S. Allen, electrical engineer, 43, Fossgate, York.—Receiving order made August 18th on a creditor's petition.

J. Sunshine, trading with others as the Lloyd Electric Lamp Co., wholesale electrical accessories dealers, 8, Rangoon Street, E.C.3 (separate application).—Discharge suspended for nine months until April 24th, 1937.

P. T. Bradley, radio engineer, 1, The Arcade, and 10, Church Lane, Stafford.—Trustee, Mr. R. E. Clark, 17, Albion Street, Hanley, Stoke-on-Trent, appointed August 17th.

D. A. Bolton, electrical contractor, Palace Chambers, Bridge Street, Westminster, S.W.—Discharged as from August 12th.

H. Shulman, electrician, 5, Bayston Road, N.16.—Discharged as from August 21st.

J. H. Dinham and **J. H. Meredith** (Electra Contracting Co.), electrical contractors, 50, New Zealand Road, Cardiff.—Trustee, Mr. L. S. Findlay, 35, Windsor Place, Cardiff, released July 14th.

P. T. King, electrical engineer, 8, Buxton Road and 20, Gordon Street, Luton.—Last day for receiving proofs for dividend September 1st. Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver.

S. E. Oliver, electrical and radio engineer, 121, Adnitt Road, Northampton.—Last day for receiving proofs for dividend September 1st. Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver.

J. W. Roberts, electrician, 19, Twiss Green Lane, Culcheth.—First and final dividend of 9½d. in the £, payable August 28th at the Official Receiver's office, Byrom Street, Manchester.

H. Vernon, electrical contractor, 105, Palatine Road, Northenden, Manchester.—First and final dividend of 1s. 4½d. in the £, payable September 2nd, at the Official Receiver's Office, Byrom Street, Manchester.

Company Liquidations

Electrical Equipment & Carbon Co., Ltd.—Particulars of claims by September 14th to Mr. C. C. Lyon, 69, Leadenhall Street, E.C.3, or Mr. C. J. Maples, 45, London Wall, E.C., joint liquidators.

Protos Electric, Ltd.—Winding up voluntarily. Liquidator, Mr. J. A. Milne, 39, Lime Grove, Eastcote, Middlesex. Meeting, September 18th, at New Bridge Street House, E.C.4, to receive an account of the winding-up.

Sanford Radio, Electrical & Photographic, Ltd.—Particulars of claims by September 1st to the liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Electric Cushions, Ltd.—Meetings September 22nd at 73, Basinghall Street, E.C.2, to receive an account of the winding-up by the liquidator, Mr. G. H. Warmington.

Albany Engineering Co., Ltd.—Meeting September 28th at Albany Works, Ossory Road, S.E.1, to receive an account of the winding-up by the liquidator, Mr. R. A. Salaman.

Private Arrangement

C. Shaw, electrician, Bradley Street, Southport.—The creditors herein met on August 21st at Southport, when the statement of affairs showed liabilities of £208, all due to the trade. After allowing for preferential claims the net assets were £99, leaving a deficiency of £109. An offer was made of a composition of 10s. in the £, payable in cash, which it was decided should be accepted.

Electricity Supply

Bacup.—LOWER CHARGES.—Reductions estimated to benefit consumers by £1,600 per annum have been made by the Electricity Committee. The fixed charge has been lowered from 15 per cent. to 12½ per cent. for the first £30 of rateable value, 10 per cent. for the next £15, and 7½ per cent. for the remainder. Reductions have also been made in the flat-rate system, states Mr. W. H. Metcalfe, the borough electrical engineer, the first 75 kWh per quarter now being charged at 5d. instead of 5¼d. per kWh. Power users will also benefit.

Barnstaple.—PROGRESS OF THE UNDERTAKING.—A net profit of £4,207 on the past year's working of the electricity undertaking is reported. Working costs were further reduced by 11 per cent. and generating costs by 13 per cent. There was an increase of 23 per cent. in the total sales of electricity for the year, and, in spite of the reduction in the average price charged per kWh sold of 17 per cent., the income of the undertaking increased by £700. The total reserves of the undertaking are now £17,984.

MAINS AND SERVICES.—The Town Council has received sanction to a loan of £3,000 for mains and services. The supply is to be extended to the Ladywell area.

Belgium.—STEAM SUPPLY BY AN ELECTRICITY COMPANY.—It is reported from Brussels that the Société Intercommunale Belge de l'Electricité, in addition to supplying electricity, has decided to establish a plant for the supply of steam to the various textile mills in the Verviers district.

Birkenhead.—OBJECTION TO SUPPLY BY LIVERPOOL CORPORATION.—The Birkenhead Corporation proposes to contest the Liverpool Corporation's application to supply electricity to the L.M.S. for the electrified Wirral railway. Birkenhead Corporation, it is understood, regards the proposal of the Liverpool Corporation as an unfair invasion of its territory.

Blackpool.—ILLUMINATIONS COMPETITION.—In connection with the Autumn Illuminations Season, café proprietors and shopkeepers are being invited to arrange private illuminations for prizes amounting to £175 given by the Corporation. There are three classes. In that for stores, large shops and cafés, the first prize is £30; second prize, £20; third prize, £15; and fourth prize, £10. In Class 2, for private hotels (unlicensed) and boarding establishments, the first prize is £25; second prize, £17; third prize, £12; and fourth prize, £6. In Class 3, for small shops and business premises, the first prize is £17; second prize, £12; third prize, £7; and fourth prize, £4. The Corporation is offering to supply electricity for temporary illumination schemes at 1½d. per kWh, and offers to hire out decorative shades, strip lighting and floodlighting projectors.

Driffield.—SUPPLY TO KILHAM.—The Buckrose Light & Power Co., Ltd., has applied to the Ministry of Transport for permission to erect high voltage overhead lines for a supply to Kilham, in the area of the Rural District Council.

Dufftown.—ELECTRICITY TO BE INTRODUCED.—Overhead cables are to be used for providing a supply of electricity in the area.

Chester.—ILLUMINATIONS.—Floodlighting of the city's buildings and parks, illumination of the River Dee, and coloured fountains will be features of the Chester Historical Attractions, 1936, from September 12th to October 18th.

Chiddingfold (Surrey).—ELECTRICITY FOR STREET LIGHTING.—Electricity is to replace oil and gas for street lighting throughout the village, the Council having accepted an offer by the Mid-Southern Utility Co., Ltd.

Dunrobin (Ross-shire).—SUPPLY AVAILABLE.—The electricity supply from the Ross-shire Electric Supply Co.'s hydro-electric station at Lochluichart is now available at Dunrobin Castle, the residence of the Duke of Sutherland. The supply is taken about 60 miles by overhead lines.

Ebchester (Co. Durham).—ELECTRICITY TO REPLACE GAS.—The parishioners have decided to install electricity for street lighting in place of gas. Three years ago a proposal to light the village by electricity was rejected. It is understood that the work will be undertaken as soon as possible.

France.—ELECTRICITY PRODUCTION.—The thermal production of electricity in France during the first six months this year was 1,704,252,445 kWh, as compared with 1,780,277,228 kWh for the same period of 1935, and the hydraulic production was 3,936,760,051 kWh, as compared with 3,544,371,935 kWh. These figures represent the production of the sixty-eight most important companies, which account for about 94.9 per cent. of the electricity produced in France, or 72.8 per cent. if allowance is made for the mining and metal industries. The thermal energy bought from the mines and the hydraulic energy imported from Switzerland by certain of the sixty-eight companies referred to have been included in the figures in order to give a better idea of electrical requirements.—*Reuter's Trade Service.*

Glasgow.—ALL-ELECTRIC HOSPITAL.—The first all-electric hospital in Scotland will be opened officially by the Corporation on October 8th. The new buildings consist of a nurses' home to accommodate 110 nurses and four wards for eighty patients which have been erected as an extension to Hawkhead Mental Hospital. Electricity will be used throughout for heating, cooking and lighting, and it is claimed by the Health Department that it will be more economical than the use of steam. The Health Department is preparing plans for a complete all-

electric hospital of 300 beds at Cowglen for patients suffering from infectious diseases. The estimated cost is £300,000.

TRANSPORT SUPPLY DISCUSSION.—The question of installing additional generating plant for traction purposes was again discussed at a recent meeting of the Transport Committee. Previously, application had been made to the Electricity Commissioners for permission to install a 25,000-kW turbo-alternator, condensing plant, switchgear, &c., at the Pinkston power station at a cost of £100,000, but the Commissioners intimated that they wished to be informed of the views of the Corporation on the revised terms that the Central Electricity Board had offered for a bulk supply of electricity at the Port Dundas station. The committee, having considered the terms of the offer, together with a report by the manager, decided not to accept the offer. The town clerk was instructed again to request the Electricity Commissioners to consent to the installation of the additional plant at the Pinkston power station.

ROAD FUND AND STREET LIGHTING.—It is proposed to make representations to the Minister of Transport with a view to obtaining grants from the Road Fund in aid of the public lighting of main roads. It is stipulated, however, that the administration of the lighting of the main roads within the city, as well as the lighting of the other streets and highways, shall remain under the control of the local authority.

Greece.—INCREASE IN ELECTRICITY OUTPUT.—The Société d'Electricité Athènes-Pirée, which supplies a population of about 850,000, reports an increase of about 11 per cent. in the sales of power during 1935 as compared with the preceding year. Excellent results are stated to have attended a campaign for increasing the use of domestic electrical appliances in the area covered by the undertaking.

Guisborough (Yorkshire).—REVISED TARIFF.—In an effort to stimulate the use of electricity for commercial heating the Urban District Council has approved a proposal by the electrical engineer (Mr. J. I. T. Norminton) to introduce a tariff of 1½d. per kWh for the first 50 kWh per quarter, 1d. per kWh for the next 240 kWh, and 0.6d. per kWh for all in excess. There will also be a discount.

Haswell (Co. Durham).—SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is to erect a sub-station near Haswell Plough.

Inverbervie.—PROPOSED ELECTRICITY SUPPLY.—The Grampian Electricity Supply Co. is to introduce a supply of electricity to Inverbervie.

Irish Free State.—LIFFEY POWER SCHEME.—Permission has been granted in the Dail for the introduction of the Liffey Reservoir Bill, which seeks to empower the Electricity Supply Board to impound the waters of the River Liffey and to generate electricity by hydraulic power, and also to increase the amount of the sums which may be advanced to the Electricity Supply Board out of the central funds.

Kent.—INSTITUTION SUPPLIES.—The County Council is to proceed with the installation of electricity at the Thanet Institution at a cost of £1,100. It has also approved an expenditure not exceeding £600 on the installation of electricity and £200 for the purchase of electrical cooking apparatus for the Malling Institution.

Malton.—OVERHEAD LINES.—No objection has been raised by the County Council to the erection of overhead lines in the parishes of Welburn and Crambe.

Manchukuo.—POWER DEVELOPMENTS.—The *Far Eastern Review* reports that the Manchuria Electric Company, of Hsinking, has drafted a plan for the erection of the first hydro-electric plant in Manchukuo. The plan will be submitted for approval to the Ministry of Industry of the Kwangtung Government and to the Kwantung Bureau in the Japanese Embassy at Hsinking. The plan, it is understood, would be carried out in five years, including a large station on the Sungari River. The first water-power station of the Choshinko Hydro-Electric Company was recently completed in North Korea.

Margate.—LOWER CHARGES.—The Isle of Thanet Electricity Supply Co., Ltd., has reduced the flat rate for lighting in the old part of the borough from 7d. to 6d. per kWh and the flat rate in the former parishes of Birchington and Westgate, now included in the borough, from 8d. to 7d. per kWh; the two-part tariff is to be available throughout the areas of supply instead of being confined to the old part of the borough. All electricity consumed by the Corporation since January 1st last is to be charged at 2d. per kWh.

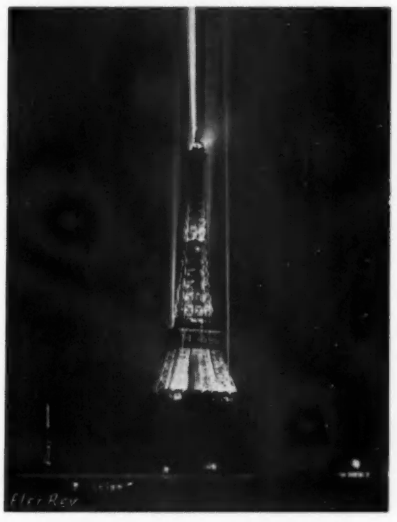
Monmouth.—RURAL SUPPLY.—The consent of the Rural District Council has been obtained to the erection of overhead lines by the Monmouth Electric Power Co. for affording a supply to Rockfield, and efforts are also to be made to secure a supply for Mitchel Troy, Trellech, Raglan and other places in the area.

Poland.—SUPPLY FOR RAILWAYS.—A contract has recently been entered into between the Ministry of Communications and two electricity undertakings (the Société de la Centrale Electrique de la Region de Varsovie and the Compagnie d'Electricité de Varsovie) for the supply of power for the electrified section of the Polish railways. The supply is not expected to commence until about the end of the year; in the meantime work is in progress in linking up the power stations of the two undertakings and the railway system.

Portland.—PROPOSED EXTENSION.—The electrical engineer has reported that he is considering the possibility of extending the supply of electricity to Portland Bill, and is in negotiation with Trinity House and other prospective consumers in the district.

Radcliffe.—LOWER CHARGES.—The Corporation has revised its charges as under:—General lighting, first 1,000 kWh per quarter at 4½d. per kWh; second 1,000 kWh at 4d.; beyond at 3¾d. Lighting by prepayment meter, 4¾d. per kWh. Heating, cooking, &c., for general use, 1d. per kWh; commercial baking and cooking, ¾d. and ½d. per kWh; storage and other heaters continuously in circuit, including tubular heaters, ¾d. per kWh; outside signs, 3d. per kWh. Street lighting, flat rate of 1½d. per kWh.

Sandbach.—ACQUISITION OF PART OF UNDERTAKING CONSIDERED.—Following an intimation that the Electricity Distribution of North Wales & District, Ltd., is applying to the Electricity Commissioners for the transfer to them of the undertakings of the North Wales Power Co., Ltd., including the Sandbach and Alsager District Special Order of 1926, the Urban District Council has decided to ascertain the Council's powers with a view to considering the suggestion that the Council should take over the undertaking, so far as it affects the Sandbach urban area.



Experimental lighting of the Eiffel Tower in preparation for the 1937 Paris Fair.

Seaham Harbour.—LOANS.—Sanction is being sought by the Urban District Council to borrow £1,000 for electricity services and £1,000 for meters.

Sittingbourne and Milton Regis.—POWER FOR WATER WORKS.—The Urban District Council has decided to use electricity at the Keycol Hill and Highsted waterworks instead of providing a Diesel engine. It will be supplied by the Kent Electric Power Co., Ltd.

Slaithwaite.—EXTENSION SCHEME REJECTED.—The Council has rejected a proposal by the Electricity Committee to extend the electricity mains to the outlying parts of the district on the ground that it would entail an annual loss and necessitate an immediate increase in the rate charged to present consumers.

Stockton-on-Tees.—LOANS.—The Town Council has received sanction to borrow £5,000 for electricity mains and £3,300 for plant.

SUB-STATIONS.—The Town Council has secured compulsory purchase powers for a sub-station site in High Street. Plans have been approved for the erection of a sub-station in Norton Road.

Stoke-on-Trent.—LOW CHARGES.—For ordinary lighting the City Council has reduced the charges from 3¾d. per kWh to 3½d., for slot meters from 4½d. to 4¼d., and for cooking and heating through a slot meter to 1½d. per kWh.

Sunderland.—LIGHTING IMPROVEMENTS.—Application is being made to the Ministry of Health for sanction to borrow £720 in connection with the lighting installations at Dene Lane and Dykelands Road.

Todmorden.—NEW EQUIPMENT.—A new transformer and switchgear are to be installed by the Electricity Committee in Portsmouth sub-station at a cost of £223.

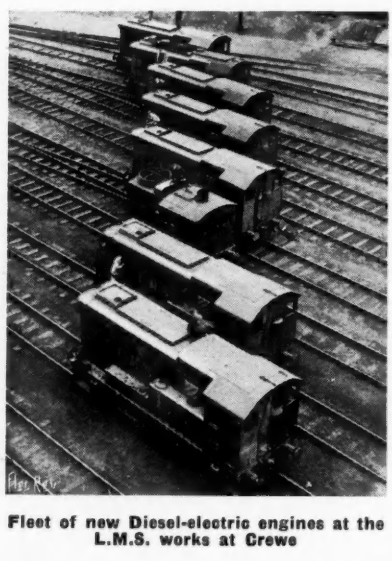
Wakefield.—LOANS.—The Corporation is seeking sanction to borrow £900 for main-road lighting and £800 for lighting new estates, and has obtained permission to borrow £4,700 for mains and sub-stations.

Wallsend.—SUB-STATIONS.—The North-Eastern Electric Supply Co. is to erect sub-stations at Back Coast Road and the Westmoreland estate.

West Hartlepool.—SUB-STATION.—Plans have been approved by the Town Council for an electricity sub-station in Middleton Grange Lane.

West Midlands.—SHROPSHIRE RURAL AREA.—The West Midlands Joint Electricity Authority, of which Mr. E. F. Hetherington is chief engineer and manager, has continued to make good progress with the electrification of its rural distribution area in Shropshire, which covers 470 square miles, having an estimated population of 101,500. Premises number 27,600, of which 14,400 are on the route of electricity mains. At March 31st there were 21 high-voltage and 5,344 low-voltage consumers, against 18 and 3,790, respectively, a year before. Sales were 7,365,825 kWh (4,451,537 kWh) at high-voltage and

2,522,592 kWh (1,727,588 kWh) at low-voltage. The average prices per kWh were 0.82d. (0.98d.) for high-voltage supplies and 2.96d. (3.11d.) for low-voltage supplies. Particularly gratifying progress has been made with the industrial load. The Authority is now giving, or has agreed to give, high-voltage supplies to twenty-four firms, representing an annual consumption of approximately ten million kWh and a revenue of £30,000 per annum. Subsequent negotiations may result in an increased sale of five million kWh and an additional revenue of £17,000. The Authority will then have obtained about 80 per cent. of the known industrial load in its area.



Fleet of new Diesel-electric engines at the L.M.S. works at Crewe

GENERATION AND SALES.—Details of the electricity generated at the various stations of the J.E.A. during the year ended March 31st last are as follows (comparative figures in parentheses):—Ocker Hill, 21,272,830 kWh (34,539,620 kWh); Wolverhampton, 34,568,300 kWh (42,999,660 kWh); Walsall, 34,420,170 kWh (33,366,960 kWh); Ironbridge, 326,716,900 kWh (258,086,000 kWh). It will be observed that the supply is being drawn to an increasing extent from the Ironbridge station, the average thermal efficiency of which during the year was 23.9 per cent. The station operated for 95 per cent. of the possible hours; the maximum load at the winter peak was 53,200 kW; and the load factor was 70 per cent. A second 50,000-kW turbo-generator was put into commission last February. Total sales for the year, excluding exports to the C.E.B., were 379,301,034 kWh against 321,236,662 kWh, an improvement of 18.1 per cent.

Whitby.—OVERHEAD LINES.—No objection is being raised by the Rural District Council to plans by the North-Eastern Electric Supply Co., Ltd., for overhead line extensions at Staithes Lane End, Whitby.

Yugoslavia.—ELECTRIFICATION SCHEME.—The Minister of Public Works, Dr. Kozul, is studying the question of regulating the rivers and water-courses in the country in order that the plan that was drawn up and partly executed before the war may be adapted to present conditions and work started this year, says *Reuter's Trade Service* from Belgrade. At the same time, Dr. Kozul is studying in detail the question of electrifying Yugoslavia. The Ministry of Public Works' Commission of Experts has already given its opinion on the general electrification of the country, and the plan for the execution of the work is largely based on its report. The Minister has set out the electrification plan in the form of a decree, which has been distributed to the Ministers interested in order that they may express their views and make proposals. As soon as all this material has been collected he will submit proposals to the Cabinet.

Traction

Australia.—LARGE TRAFFIC SIGNALLING INSTALLATION.—A large traffic signalling installation is to be carried out at Sydney by the New South Wales Transport Dept. at a cost of £25,000.

Glasgow.—LITTLE LIKELIHOOD OF TROLLEY-BUSES.—As a result of an adverse report following an investigation into the possibilities of introducing trolley-buses in the City, it is unlikely that such a scheme will be promoted.

Liverpool.—TRANSPORT UNDERTAKING REPORT.—An increase of over two million passengers carried by the Corporation's trams is shown in the annual report of the general manager, Mr. W. G. Marks, the total for the year ended March 31st, 1936, being 251,489,512, the mileage increase being from 20,110,440 to 20,719,444. Total revenue was £1,338,535, an increase of £13,910. A decrease of £7,510 in the surplus on the operation of the whole undertaking was due, to a great extent, to the extra cost of general repairs and maintenance to the tramways rolling stock; the trams produced a net surplus of £122,294, while there was a deficit on the buses of £31,278.

During the year forty new bogie cars were constructed at the Edge Lane Works, and during the current year 125 more similar cars will be placed in service. A considerable amount of new equipment has been provided at the depôts.

London.—RECONSTRUCTION OF SLOANE SQUARE STATION.—The District Line Sloane Square station will be completely reconstructed under plans which have been approved by the London Passenger Transport Board. Escalators, moving upwards only, will be built from both east and west platforms to a new ticket hall on the level of the present ticket hall. There will be a new station building brought forward to the building line in Sloane Square. Both platforms will be extended westward so that the escalators may rise from the middle of the platforms. The preparation of contract drawings is in hand, and work will begin before the end of the year. Sloane Square station is the deepest on the District line, being 25 ft. below the surface. It was opened in 1868, three months after the first section of the District Railway had been placed in service.

Switzerland.—ELECTRIFYING THE PILATUS MOUNTAIN RAILWAY.—The electrification of the rack railway up the Pilatus Mountain, near Lucerne, Switzerland, has been authorised. The railway, which is 2.8 miles long, with an average gradient of about 1 in 3, is to be operated by d.c. at 1,500 V. The electric trains will attain an average speed of 4.8 m.p.h., thus reducing the time occupied in making the climb from 75 to 35 minutes.

United States.—STEAM-TURBINE LOCOMOTIVE.—The Union Pacific Railroad announces the completion of plans for the first steam-turbine locomotive operated in the Americas, reports *Reuter's Trade Service* from New York. The new locomotive is expected to have a maximum speed of 110 m.p.h. with a trailing burden of 1,000 tons. It comprises two 2,500 h.p. self-contained units operating through electrical transmission. The weight per horse-power of the locomotive will be 20 per cent. less, it is estimated, than with the conventional steam locomotive, and it will be lighter than the oil-electric locomotives used on the Union Pacific system which have reduced the time between Chicago and the Pacific coast by 33 per cent. Fuel and water will be carried for continuous operation for at least 550 miles. The American General Electric Company is to build the new locomotive, delivery being scheduled for early next year.

Communications

Czechoslovakia.—NEW PRAGUE HIGH-POWER RADIO TRANSMITTER.—A transmitter of 100 kW carrier power and advanced design is to be installed near Prague. The new station will provide an alternative programme service to the 120-kW equipment at Liblice (supplied in 1929) which is now being modernised. The Prague transmitter is being manufactured at the works of Standard Telephones & Cables, Ltd., and it will be the first of its size using the modern system of high-power class "B" modulation to be supplied to the Continent by that company. In design it follows closely equipments manufactured for the British Broadcasting Corporation; one 100-kW medium-wave and two high-power short-wave transmitters use the same method of operation. The use of the cubicle system of construction for the high-power stages will be a special feature of the station at Prague, and the arrangement of the cubicles on entirely novel lines in the new station has many advantages over all previous systems of construction. In the case of high-power broadcast transmitters it has long been the practice to mount spare valves in position in the equipment in order to provide a quick change-over in the event of failure. In the new system, the provision of spare valves complete with the immediately associated circuits gives a greatly increased factor of safety and a much higher guarantee against breakdown. Further, the arrangement of the transmitter allows the operators full access to all the spare parts of the equipment which are not actually in use, and work on these may proceed while the station is transmitting. It is anticipated that this new station will be cut over towards the end of 1937.

Great Britain.—AEROPLANE RADIO SERVICE.—A new service which is being provided by Imperial Airways is a radio service which enables passengers to send or receive messages to or from ground stations.

TELEVISION.—As we mention in the article on page 271 of this issue, the first public reception of high-definition television in this country is available for visitors to the Radio Exhibition at Olympia. The transmissions are from Alexandra Palace, and are purely of an experimental nature. They are given twice daily, for the period of the exhibition, from 12 noon to 1.30 p.m., and from 4.30 until 6 p.m. (approx.). Transmissions are given on alternate days by the Baird and Marconi-E.M.I. systems.

LONDON'S HUNDREDTH AUTOMATIC EXCHANGE.—Stepney Green was the hundredth telephone exchange in the London area to be transferred to automatic operation, the ceremony taking place last Saturday. There are still about 150 manually operated exchanges in the area, but more than 50 per cent. of the subscribers' lines are connected to automatic exchanges.

IMPROVING THE TELEPHONE SERVICE.—The offices of the north-eastern regional director, Col. T. P. Hopkins, and other Post Office establishments in Leeds were visited by the Postmaster-General last week, when he referred to the development work which has been carried out. Last month orders were secured for nearly 6,000 more telephones than were obtained in June, and over 5,000 of these were residential. The rapid growth in inland trunk traffic is demonstrated by the fact that, whereas in the summer of last year there were about 560,000 long-distance calls per week, in June and July this year the weekly averages were 654,000 and 670,000 respectively. In the week preceding August Bank Holiday the number was 700,000.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Arbroath.—September 5th. Town Council. Alterations and extension to public library (including electrical work). Schedules (£1) from Carver, Symon, & Ross, Chartered Architects, Surveyors, 126, High Street. Tenders to town clerk.

Atcham (SALOP).—September 22nd. R.D.C. Electric (alternatively, oil engine) driven borehole pumping plant in duplicate. Messrs. Willcox, Raikes & Marshall, 33, Great Charles Street, Birmingham (£2 2s.).

Australia.—SYDNEY.—November 2nd. County Council. Steam generating plant at the Bunnerong station. (T.Y. 30651.)*

Birmingham.—August 31st. Electric Supply Committee. One set of d.c. over-voltage testing equipment. (August 14th.)

Blackpool.—August 31st. Borough Council. 6,600-V, 50-cycle, 3-phase transformers. (August 14th.)

Buxton.—September 8th. Electricity Department. L.v. cables (see this issue).

Cardiff.—September 12th. Electricity Department. Supply and erection of an h.v. overhead and underground transmission line at Pentyrch and l.v. distribution lines in East Aberthaw. (August 21st.)

Chile.—SANTIAGO.—September 25th. Ministry of National Defence. Electric portal crane. (T.Y. 30670.)*

Chipping Sodbury.—August 31st. Gloucestershire C.C. Electric lighting installation for new grammar school. County architect, Shire Hall, Gloucester (£2 2s.).

Coulsdon and Purley.—U.D.C. Wiring for electric lighting and clocks at the Council offices extension. (August 21st.)

Darlington.—September 15th. Corporation. Trolley vehicles. (See this issue.)

Dunbar.—September 1st. Town Council. Heating and electrical works at entertainment pavilion. Schedules (£1) from, and tenders to, J. D. Brooke, Town Clerk.

Dundee.—August 31st. Corporation. Electric lighting installation at housing estates (164 houses). City quantity surveyor, 21, City Square. Tenders to town clerk.

Dumfries.—September 18th. Electricity Department. Steel switch and transformer kiosk. (August 21st.)

Egypt.—CAIRO.—September 28th. Mechanical and Electrical Department, Ministry of Public Works. Air-conditioning plant for the new Chemical Department building. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, London, S.W.1 (deposit £1 10s. 9d., not returnable).

October 20th. Supply and erection of Naga Hamadi hydro-electric and electric pumping stations. Chief inspecting engineer (deposit £5 2s. 6d., not returnable).

Farnworth.—September 7th. Electricity Department. Wiring cables and cooker control units. (August 21st.)

Felling-on-Tyne.—Education Committee. Electric lighting in the Falls Park Road, Felling Shore and Bill Quay Schools and for similar work at the caretakers' house at Heworth School. Mr. C. W. Hall, architect, Council Offices.

Folkestone.—September 14th. Corporation. Internal and external wiring of 453 houses and flats on the Canterbury Road housing estate. (August 7th.)

Glasgow.—September 1st. Corporation. Heating and electrical installation at Bridgeton Clinic. Office of Public Works, City Chambers (Room 81) (deposit £2 2s.).

India.—SIMLA.—September 1st. Stores Department. Seventy-five three-pole, automatic time switches. (T.Y. 30611.)*

September 11th. Bombay, Baroda and Central India Railway Co. Plates and separators for train lighting accumulators. (See this issue.)

Kirkcaldy.—September 4th. Burgh Council. Conversion of consumers' d.c. plant and installations for a.c. supply. (August 14th.)

Replacement of consumers' d.c. meters for a.c. supply. (August 21st.)

London.—METROPOLITAN WATER BOARD.—October 5th. Four high-compression heavy fuel oil engines with centrifugal pumps and electrical generators, three electrically driven borehole pumps, switchboard and appurtenant works at the Crayford pumping station. Chief engineer, Offices of the Board, Room 235, 173, Rosebery Avenue, W.C.1 (deposit £2 2s. with the Comptroller to the Board).

HACKNEY.—September 7th. Borough Council. Electrical installation at a block of flats. (See this issue.)

September 23rd. Electrical installation at a block of flats. (See this issue.)

OFFICE OF WORKS.—September 10th. Wiring for power and lighting at M/L Redbridge, Southampton. (See this issue.)

New Zealand.—WELLINGTON.—October 27th. Public Works Department. 33-kV/11-kV transformer bank. (T.Y. 30574.)*

October 20th. Electric motor-driven centrifugal pump. (T.Y. 30688.)*

November 3rd. Motor operated weir penstock gate and equipment for water rheostat. (T.Y. 30576.)* 22,200-kVA generator and turbine. (T.Y. 30573.)*

October 13th. Two metal-clad oil circuit-breakers. (T.Y. 30698.)*

October 27th. Three 66-kV potential transformers. (T.Y. 30690.)* Four 66-kV oil-immersed circuit-breakers. (T.Y. 30697.)* Two 5-ton and one 2-ton electric cranes. (T.Y. 30695.)*

AUCKLAND.—October 6th. Public Works Department. Two outdoor-type, 110,000-V, 400-A, 3-phase oil-immersed circuit-breakers (T.30696).*

Northern Ireland.—BELFAST.—September 7th. Harbour Commissioners. 15-ton electrically operated travelling gantry crane (3-phase, 380-V, 50-cycles), for the Thompson graving dock. T. N. Burke, superintendent of cranes, Harbour Office.

Plymouth.—August 29th. Corporation. L.v. distribution boards. City electrical engineer.

Radcliffe-on-Trent.—September 9th. Committee of Visitors. Electrically driven equipment, including vacuum pump, mixer, potato peeler, potato-chipping machine, and slicing machine, for Notts County Mental Hospital. Clerk of the Hospital.

Sheffield.—September 7th. Electricity Department. Five 600-kVA, 3-phase, 11,400/400-V outdoor type transformers. (See this issue.)

South Africa.—JOHANNESBURG.—Railways and Harbours Administration. September 28th. Two electric battery tractors. (T.Y. 30605.)*

PRETORIA.—September 11th. Union Tender and Supplies Board. Automatic time check apparatus, master clock, relays, oscillator and time checks. (T.Y. 30625.)*

CAPE TOWN.—September 16th. Electricity Department. Nine 1,000-kVA, twelve 500-kVA, and twelve 300-kVA, 3-phase transformers. (T.Y. 30654.)*

Stoke-on-Trent.—September 9th. Electrical Engineer's Department. Domestic electric cookers, wash-boilers and kettles (see this issue).

Sunderland.—August 31st. Corporation. P.i. cable, r.i. wire, consumers' meters and electric lamps for twelve months ending October 31st, 1937. (August 7th.)

Swansea.—August 31st. Electricity Department. Six and a half miles of overhead 33,000-V line on galvanised steel lattice towers. (August 14th.)

Teddington.—September 10th. U.D.C. Traffic signals in Broad Street. E. Bostock, surveyor, Council Offices (deposit £2).

Turriff.—September 4th. Town Council. Electric lighting installation at housing estate. Burgh Surveyor.

Warrington.—September 7th. Electricity Department. (*a*) Extra-high-voltage and low-voltage and lead-covered and other cables; (*b*) earthenware conduits; and (*c*) reinforced concrete cable protector slabs and tiles. (August 21st.)

Warwick.—September 14th. Warwick Joint Hospital Board. Electrical installation in the extension to Heathcote Isolation Hospital and new laundry. Tenders to the Clerk of the Joint Board.

West Ham.—August 31st. Borough Council. Transformers, v.i.r. and tough rubber sheathed wires and cables for twelve months ending September 30th, 1937. (August 14th.)

West Midlands.—September 22nd. Joint Electricity Authority. (*a*) 33-kV transmission switchgear and step-down transformers; and (*b*) 11-kV distribution switchgear. (See this issue.)

Wickersley (nr. Rotherham).—September 5th. Electric lighting at Maternity Home. West Riding Architect, County Hall, Wakefield.

Worthing.—September 11th. Electricity Department. (*a*) Supervisory control equipment, e.h.v. switchgear and transformers; and (*b*) kiosk sub-stations and transformers. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Banff.—Town Council. Accepted. Electric street lighting equipment.—T. Laurie & Co., Ltd.

Dalbeattie.—Town Council. Accepted. Installation of electric lighting in houses at Craigmath.—R. Dunn & Sons.

Darlington.—Town Council. Accepted. Eight transformers.—Yorkshire Electric Transformer Co., Ltd.

Glasgow.—Transport Committee. Accepted. Lead-covered cable.—Standard Telephones & Cables, Ltd.; Craigpark Electric Cable Co., Ltd.

Corporation. Accepted. Electrical installation at Govan Police headquarters (£380).—Cross & McIlwham.

Greenock.—Corporation. Accepted. X-ray apparatus.—C. F. Howden.

Middlesbrough.—Town Council. Accepted. Two transformers.—Electric Construction Co.

Electric cable.—B.I. Cables; Macintosh Cable Co.; Hackbridge Cable Co.; Enfield Cable Works. Circuit-breakers.—English Electric Co.

Newcastle-on-Tyne.—City Council. Accepted. Electrical installation at the Atkinson Road School (£311).—A. S. Lowery.

South Africa.—CAPE TOWN.—Electricity Committee.—Accepted. 2,000 Ferranti house service meters.—Albert Vaux & Co. Two passenger lifts at Electricity House.—Waygood-Otis, Ltd.

Stirling.—Town Council. Accepted. Electrical work at houses in Drip Road.—James Scott & Co.

Stockton-on-Tees.—Town Council. Accepted. Electrical installation at the Newtown Schools (£105).—R. Pickersgill & Son.

Wallasey.—Electricity Committee. Accepted. Metering equipment (£151).—English Electric Co., Ltd.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

HILLSTON glassware.

Electrical fittings in iron bearing the mark, "C. E. & Co., Ltd."

Glass-enclosed high-temperature fuses for use with immersion-heater electric kettles.

Readers should enclose stamped addressed envelopes when making their inquiries.

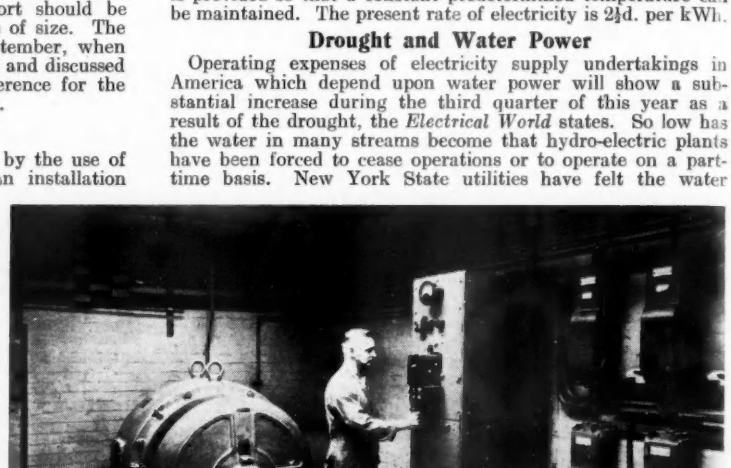
Notes

Opposition to the McGowan Report

Representatives of the smaller electricity undertakings in Staffordshire met at the Newcastle Electricity Department's offices last week to consider the recommendations contained in the McGowan Report. They were unanimously of the opinion that the aims and objects of the report could, to a very large extent, be achieved without resorting to compulsory acquisition or amalgamation. The opinion was unanimously expressed that Clause 152 of the report should be made applicable to every authority, irrespective of size. The meeting was adjourned until the middle of September, when certain alternative proposals will be put forward and discussed prior to the probable calling of a similar conference for the whole of the smaller authorities in the country.

Power-factor Correction

A striking example of the economies effected by the use of power-factor correction motors is given by an installation carried out at the Co-operative Society Laundry, Norris Green, Liverpool, where the annual saving in the cost of power is estimated at £500. The equipment installed, illustrated in the accompanying picture, includes a "No-Lag" motor rated at 360 kVA, 400 V, 750 r.p.m., 50 cycles, together with a cubicle mounted circuit-breaker of 700-A capacity and a liquid rotor starter, part of which can be seen in the corner between the machine and the circuit-breaker. This installation corrects power factor of a load of 525 kW from 0.65 to 0.9, thus changing a 10 per cent. surcharge in the cost of electricity due to the power factor being below 0.8 to a rebate of 5 per cent. due to the raising of the value above 0.9. The electrical equipment was supplied by the British Thomson-Houston Co., Ltd., to Messrs. R. Seddon & Sons, the electrical contractors.

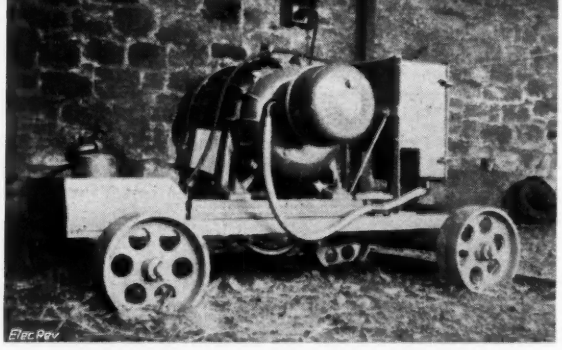


A 360-kVA motor which improves the power factor of a laundry plant from 0.65 to 0.9

A Bogie for Farm Motors

Electricity continues to be adopted more and more as the motive power on farms in the large area covered by the North-Eastern Electric Supply Co., Ltd. Recently the two farms, Stamford and South Mill, near Embleton, Northumberland, the property of Mr. W. Robertson, who owns and farms some 2,200 acres, acquired a portable type of prime mover for driving the threshing machines and other machinery used there, and the North-Eastern Electric Supply Company's engineers designed a steel bogie, the framework of which is electrically welded throughout with the sole exception of the bracket supporting the starter.

Three of these bogies are in use, each equipped with an 18-h.p. Brook three-phase surface-cooled 1,000-r.p.m. slip-ring motor, with starter and trailing cable, and are giving every satisfaction in operation. The bogies were made very low with a view to easy anchoring when in use. In addition to motive power both farm-houses (requiring sixty and eighty lighting points) and the twenty-five cottages attached to them, were wired for lighting and heating.



A farm motor on a specially designed bogie

The Diesel Engine Users' Association

The Diesel Engine Users' Association will open its 1936-37 session on October 12th with a paper on "The Present Position of Special Steels for Diesel Engines," by Dr. S. F. Dorey. Other papers to be read during the session include "The Application of Diesel Engines to Rail Traction," by Mr. T. Hornbuckle, and "Improvements in the Economy and Output of Heavy Oil Engines," by Mr. J. Calderwood. The annual dinner will be held on February 10th.

Electric Heating in the East

An electro-steam radiator, made in Palestine to suit local conditions, has just been exhibited at the Haifa Metal Works, an important local engineering factory.

Consisting of an ordinary radiator to which an electrically heated boiler is attached, the whole apparatus is mounted on rollers. The steam generated in the boiler circulates through the radiator. The consumption is 0.8 kWh per hour for an average room of 2,000 cu. ft. An automatic cut-off is provided so that a constant predetermined temperature can be maintained. The present rate of electricity is 2½d. per kWh.

Drought and Water Power

Operating expenses of electricity supply undertakings in America which depend upon water power will show a substantial increase during the third quarter of this year as a result of the drought, the *Electrical World* states. So low has the water in many streams become that hydro-electric plants have been forced to cease operations or to operate on a part-time basis. New York State utilities have felt the water shortage as well as those operating in Pennsylvania, Minnesota, northern Michigan, Wisconsin and other drought sections. This means that such undertakings are now being forced to start up steam plants to meet demand.

Electricity in Mines

The introduction of electricity on a large scale into the Rhondda Collieries of the Ocean Coal Co. is regarded by Mr. J. V. Harries, in an article in the *Ocean & National Magazine*, as symptomatic of a general attempt to modernise pits the economic existence of which might otherwise be difficult to justify. He believes that the rapid progress in machine mining in Scotland, Northumberland, Durham and South Yorkshire handicaps South Wales, where the advance has been slower, in competition. He urges that underground haulages and pumping systems should be electrified and that the less efficient compressed air should be retained only at the face. Nevertheless, he regards electricity as comparing favourably with compressed air from the safety aspect.

An Alpine Generating Plant

The Dixence hydro-electric power station, Switzerland, claims to utilise the highest head in the world. It is situated in the Rhône Valley not very far from the town of Sion. The water is impounded in a storage lake with a capaciy of about 1,800 million cu. ft. A tunnel cut in the rock connects the storage lake with the head chamber, from where the water is led in steeply inclined pressure pipes to the power station below. The difference in level between the head chamber and the turbines is 5,740 ft. Provision has been made for five 30,000-kW sets, three units being installed in the initial stage. Each set consists of the generator with a 21,250 h.p. Pelton wheel mounted overhung at either end; with this arrangement it is possible to support the whole rotating part in two bearings. The speed of sets is 500 r.p.m. The 13-kV generators, which were supplied by the Oerlikon Co., have a normal continuous output of 37,500 kVA and a maximum output of 43,000 kVA for three hours at a power factor of .8.

Appointments Vacant

Assistant mains engineer for Sheffield Electricity Department.

Meter mechanician for Hull Electricity Department.

Mains superintendent for Loughborough Electricity Department.

Graduate lecturer in electrical engineering at the Borough Polytechnic, London, S.E.1.

Electrical engineering assistants in drawing office for the Air Ministry.

(See our classified advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. N. W. J. Osborne, mains superintendent engineer with the Loughborough electricity undertaking, has been appointed to a similar position with the Worthing Corporation. Mr. Osborne gained his early experience with the Bath Corporation, and from there went to Loughborough, where he entered the service of the Brush Electrical Engineering Co. He joined the Loughborough electricity undertaking in 1926.

Mr. E. C. Lennox, this year's president of the Association of Public Lighting Engineers, which is to hold its annual conference at Cheltenham from September 7th to September 10th, is a member of the staff of the North-Eastern Electric Supply Co., Ltd. He is a native of Gateshead, and began work with the North-Eastern Electric Supply Co. (then known as the Newcastle Electric Supply Co., Ltd.) in 1914. He served with the forces during the war. Mr. Lennox is a member of the Institution of Electrical Engineers and of the British Electrical Development Association's Street Lighting Committee, and is the author of several papers on electrical development and street lighting.

Mr. R. W. Wilson, B.Sc., A.M.I.E.E., author of the article "A Tariff Line Chart," published on page 270. was lecturer in the Electrical Engineering Department at Loughborough College from 1928-35, leaving to take up the position of Head of the Engineering Department at Cheltenham Technical College. He has recently been appointed Vice-Principal of the new Blackpool Technical College.

Mr. and Mrs. E. E. Sharp, whose marriage was reported in our last issue, left on Thursday last week for a transatlantic tour. Before their departure from Euston they gave our photographer a special "sitting"

Mr. S. J. Bailey, who is on the engineering staff of the Central Electricity Board, was married on August 15th, at Birkenhead, to Miss Winifred Fitzpatrick.

Mr. G. N. Higgs, technical director of Synplas, Ltd., is to visit America during September to study American methods of plastic moulding, and during his tour he will visit a number of the largest moulding concerns in the United States.

Mr. G. R. Todman has been appointed manager of the Meter Department of Siemens Electric Lamps and Supplies, Ltd. Mr. Todman was with the General Electric Co., Ltd., Witton and Calcutta, and lately with Philips Industrial (Philips Lamps, Ltd.).

Mr. S. S. Foster, deputy electrical engineer to the Hoylake Urban District Council has been appointed electrical engineer and manager in succession to Mr. C. J. Turner who has retired, owing to ill-health, after thirty-four years' service. Mr. Foster has been with the Hoylake Council as deputy electrical engineer since 1908, and for a time during the war period was acting engineer. He had previously held appointments with the Derby and Notts Electric Power Co., the St. Pancras Borough Council, and Lowestoft Corporation.

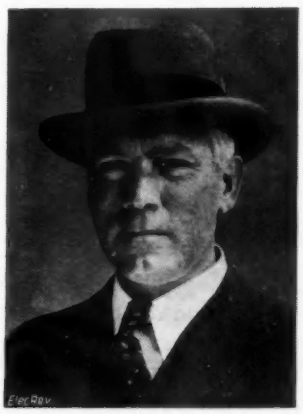
Dr. H. J. Van der Bijl, chairman of the South African Iron and Steel Corporation, and chairman of the South African Electricity Commission, is now in London on a short visit before leaving for America. Dr. Van der Bijl is also interested in the Empire Exhibition which is being held in Johannesburg, and is a member of the executive committee.

Mr. P. H. Jackson, who recently resigned from Messrs. Pooley & Austin, Ltd., on whose behalf he handled the switchgear sales of Messrs. Drake & Gorham, Ltd., has now been appointed technical sales engineer for the South of England to Switchgear & Equipment, Ltd.

Mr. R. Foggo, who, with his father, Mr. Ronald Foggo, has an electrical business in Church Street, Dewsbury, was married on August 18th to Miss Margaret E. Asquith.

Obituary

Mr. J. L. Hodgson.—The death occurred on August 19th of Mr. John Lawrence Hodgson, B.Sc. (London), M.I.Mech.E., technical adviser to Messrs. George Kent, Ltd., at the age of fifty-five. His engineering interests covered a wide range and included aeronautical and marine engineering, pumping machinery, ventilation for mining and many other inventions. He designed the first Venturi air meters which were installed by the Victoria Falls and Transvaal Power Co.



Three personalities of the week: From left to right: Mr. R. W. Wilson, B.Sc., author of "A Tariff Line Chart" on page 270; Dr. H. J. Van der Bijl (South Africa), who is now in London; and Mr. E. C. Lennox, president of the A.P.L.E.

Mr. J. Wrench informs us that he has terminated his engagement as engineer with Messrs. Armco, Ltd.

I.E.E. Awards.—The following scholarships have been awarded by the Institution of Electrical Engineers for 1936:—Ferranti (annual value £250; tenable for two years), to Mr. W. E. Harper (Birmingham University). Duddell (annual value £150; tenable for three years), to Mr. P. Hargreaves (Lower School of John Lyon, Harrow). Silvanus Thompson (annual value £100, plus tuition fees; tenable for two years), to Mr. L. S. Anand (North-Western Railway, India). Swan Memorial (annual value £120; tenable for one year), to Mr. D. H. Thomas (Metropolitan-Vickers Electrical Co.). David Hughes (value £100; tenable for one year), to Mr. W. H. Penley (Liverpool University). Salomons (value £100; tenable for one year), to Mr. E. F. O. Masters (City and Guilds College). Thorrowgood (annual value £25; tenable for two years), to Mr. L. G. Leaton (Southern Railway Co.).

Mr. W. J. Short, of 53, Long Lover Lane, Pellon, whose death is announced, had for sixteen years been in business as an electrical engineer and contractor at Halifax. He was a member of the Halifax Electrical Employers' Federation.

Mr. E. Bushden, who has died at the age of sixty-seven years, was managing director of Garnish & Lemon, Ltd., electrical and general engineers, of Pilton, Barnstaple.

Wills.—Mr. Stanley Grainger, a director of the Hart Accumulator Co., Ltd., left £2,146 (net personalty £1,673).

Mr. H. Barker, chairman of the Hankow Light and Power Co., left £17,665, with net personalty £17,230.

The Industrial Situation in Japan

An American professor's views

PROFESSOR D. G. Jackson, of the Massachusetts Institute of Technology, has made an exhaustive study of Japanese industrial processes and their results during visits to that country, and in an article contributed to the *Electrical World* he gives the impressions gained as the result of his observations.

He states that the often-expressed view that the Japanese always will be copyists and followers in their industrial processes and production has been proved to be wrong by the developed status of industry and invention in Japan. The dominant Japanese engineering industries (that is, industries in which the products are manufactured in great quantities by machines), are in fields occupied by dominant industries throughout the world. Being, in general, short of raw materials of her own, except those from which "luxuries" like silk and tea are derived, she has felt that she must direct the bulk of her manufacturing towards articles which may be readily produced from raw materials that are cheaply and continuously obtainable in world commerce.

Referring to the electrical industries, Professor Jackson states that the progress made during the last decade has been great, and the prosperity of these industries undoubtedly will continue so long as Japan's exports of industrial products are maintained, although the extent of export of electrical equipment itself is not now relatively large. He points out that while in the early stages the Japanese electrical industries were aided by American and other foreign capital and management, the management now is mostly Japanese, although foreign companies maintain more or less intimate advisory relations in some instances.

There are now in Japan three manufacturing companies competent to design and construct large generators for steam-turbine and hydro-electric turbine sets as well as large generators and motors for other purposes. Either themselves or through affiliated concerns, these companies manufacture the turbines. The same companies and many others produce a wide range of electrical machinery of smaller types and calibre. The annual output of these factories runs into a considerable sum. The factories are busily occupied and seem to be on a profitable basis. General sentiment in this field seems to anticipate a continuation of satisfacory demand for electrical machinery for several years.

Large Generating Plant

Most of the products are absorbed in Japan and Manchukuo, but China and other Oriental regions are awakening to the larger use of electricity for light and power, and a spirit of optimism prevails in electrical machinery circles. The greatest rated capacity of individual electrical machines yet designed in Japan is 50,000 kVA in steam turbo-generators. Generators of 75,000 kVA individual capacity have been designed and are likely to be constructed for further plant extensions. Japanese engineers lean toward 3,000 r.p.m. for large steam-turbine generating sets. Their generating sets run excellently and reliably. Specific figures for steam economy do not seem to be available. In hydro-electric generators even larger machines, relatively, although of smaller rated capacity, have been built, such as individual capacities of 35,000 kVA.

The generally used standard voltage for high-voltage transmission is 135,000 V, and the Japanese are successfully building both three-phase and single-phase transformers of large individual capacities, more or less following usual designs. Coal is of moderate price in Japan and fuel is generally relied upon for power generation. But the Japanese have developed and continue to develop their available water power wherever convenience and economy dictate.

The railroads of Japan, which are of narrow gauge construction, are owned and operated by the Government through a Ministry of Railways. The main line from the north of Tokyo, through Tokyo, Yokohama, Nagoya, Kyoto and Osaka, to Kobe carries a heavy passenger traffic, and a good part of this line is electrified. Early sub-station equipment included rotary-convertor machinery, but mercury-arc rectifiers have gone into the most recent installations. Japanese engineers have proved themselves competent designers of both types of plant. Engineers of the Railway Ministry claim that electrification has proved economical. Originally the Ministry bought a number of American and European electric locomotives along with locomotives of Japanese make, but the more recent locomotives have all been Japanese.

The telegraph and telephone systems of Japan are also owned and operated by the Government through a Ministry of Communications. Telegraph service is good and relatively cheap. Radio broadcasting is directed by the Government, and manufacturers of receiving equipment apparently have had notable prosperity.

In more general lines of electrical apparatus such as electric lamps, lighting fittings, household appliances, fractional h.p. motors and storage batteries, Japan is also substantially self-sufficient. About half a million lamps are made daily, perhaps one-third of them being made in one factory which is of a modern and economical type, and which possesses its own research laboratory to determine controls of production and to originate new products or processes.

The Competitive Position

In conclusion Professor Jackson deals with Japanese electrical industry as affecting the American electrical trade. He states that the industrialisation of Japan depends on the export trade to a degree which is difficult for Americans to appreciate. Japan can no longer be looked upon as an important market for American electrical apparatus and is likely to become a strong competitor for electrical business in other foreign markets. American prices are too high to compete in Japan and the production centres are too far away from that country even if the Japanese desire for self-sufficiency were relaxed.

The existing competition in the field of electrical equipment in Japan is European, and particularly German, since the German manufacturers secure advantages through the status of German money (marks) in foreign trade. In Japan proper, including Old Japan, Korea and Formosa, this foreign competition is not particularly noticeable, and the competition there felt by the electrical manufacturers is mostly intra-Japanese. In other trade, however, even where the Japanese influence is large, as in Manchukuo and China, this foreign competition is still able to make itself felt, and European companies secure a good deal of electrical equipment business, as do also American concerns (but rather haltingly) in China.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Thompson Bros. (South Shields), Ltd.—Private company. Registered August 18th. Capital, £2,000. Objects: To acquire the business of wireless dealers and electrical engineers carried on by J. E., H. and T. Thompson at South Shields. The permanent directors ars: J. E. Thompson, 35, Harton Rise; H. Thompson, 1, Nichols Buildings; and T. Thompson, 10, Osborne Terrace, all South Shields. Secretary: A. A. Rankin. Registered office: 136, Fowler Street, South Shields.

Simplak Batteries, Ltd.—Private company. Registered August 17th. Capital, £2,000. Objects: To acquire rights in and to exploit inventions relating to containers for electrical accumulators and the adaptation thereof for electric lamps, &c. The subscribers are: W. H. Barnes and J. York, both of Lloyd's Buildings, Leadenhall Street, E.C. Registered office: British Industries House, Marble Arch, W.1.

Powers of Barnet, Ltd.—Private company. Registered August 17th. Capital, £600. Objects: To acquire the business of an electrician, radio dealer and undertaker now carried on by E. J. Hewett at 15, Station Road, Barnet, as "Powers of Barnet." The directors are: E. J. Hewett, 18, Mount Avenue, Westcliff-on-Sea; and G. E. Hewett, 107, Kenton Road, Kenton, Middlesex. Secretary: G. E. Hewett. Registered office: 107, Kenton Road, Kenton, Middlesex.

Multiplex (Yorkshire), Ltd.—Private company. Registered August 20th. Capital, £600. Objects: To carry on the business of manufacturers of and dealers in electrical, gas and oil lamps, quartz lamps, reflectors, bells, fires, stoves, &c. The directors are: E. H. Barker, Langlands, St. John's Park, Menston, nr. Leeds, and two others. Secretary: E. W. Knox. Regd. office: 17, Little Horton Lane, Bradford.

Bosch, Hall, Ltd.—Private company. Regd. August 20th. Capital, £1,000. Objects, To carry on the business of manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, &c. The first and permanent directors are: F J. Van den Bosch, C. P. Hall, T. Arthur-Lines, and M. H. Shepherd. Solicitor: J. Rothwell Dyson, 38, Gresham St., E.C.2.

Mackenzie, Williams, Ltd.—Private company. Registered August 20th. Capital, £1,500. Objects: To carry on the busi-

ness of manufacturers of and dealers in electrical, gas and oil lamps, quartz lamps, reflectors, bells, fires, stoves, cookers, switchboards, &c. The directors are: J. E. Mackenie, 30, Grosvenor Gdns., Boscombe, and G. Williams, Upton Way, Broadstone, Dorset. Secretary: F. D. Pickering. Regd. office: 75a, Commercial Road, Bournemouth.

Hulme's Radio Services, Ltd.—Private company. Registered August 1st. Capital, £100. Objects: To acquire the business of a radio dealer carried on by W. H. Hulme, at 158, County Road, Liverpool, 22, Irlam Road, Bootle, 1b, Berry Street, Bootle, 52, Selwyn Street, Liverpool, 4, and 58, Houghten Street, Prescot, nr. Liverpool, as "Hulme's Radio Services." The subscribers are: W. H. Hulme, 52, Selwyn Street, Liverpool, N., and two others. Registered office: 52, Selwyn Street, Liverpool, N.

Autophone, Ltd.—Private company. Registered August 4th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in clocks, timing and other recording instruments or apparatus, telegraphic, telephonic, radio and television apparatus, &c. The subscribers are: J. C. Cowles, 74, Dale View Crescent, Chingford, and F. W. Bailey, 1, Denmark Villas, Wilmot Road, Leyton. Registered office: 272/4, Vauxhall Bridge Road, S.W.1.

Britannia Radio & Television Co., Ltd.—Private company. Registered August 21st. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in radio and television apparatus, &c. The subscribers are: Miss K. M. Wilding, 10, Gordon Road, Ealing, W.5., and J. Peters, 68, Queenborough Gardens, Cranbrook Road, Ilford. Qualification: 5 shares. Secretary: J. Peters. Regd. office: 14, Sunbeam Road, Park Royal, N.W.10.

Meter Wireless, Ltd.—Private company. Registered August 21st. Capital, £10,000. Objects: To adopt an agreement with L. E. Falcy, and to carry on the business of manufacturers and repairers of and dealers in and hirers of electrical and mechanical apparatus and accessories, wireless sets, &c. The permanent directors are: L. E. Falcy (managing director), Danby House, Church St., Salisbury, and H. French, 230a, Shirley Road, Southampton. Solicitors: Hodding, Jackson & Bentham, Castle Chambers, Salisbury.

Electrical Services (St. Albans), Ltd.—Private company. Registered August 21st. Capital, £7,500. Objects. To carry on the business of makers of and dealers in electrical or chemical appliances, electricians, mechanical engineers, suppliers of electricity, &c. The directors are: W. S. Jennings, 276, Droylesden Road, Newton Heath, Manchester; Miss A. Jones, One Ash, Marple, Ches.; and S. J. Plester, 14, Water Lane, Watford. Registered office: 14, Water Lane, Watford.

P. T. Danby & Co., Ltd.—Private company. Registered August 19th. Capital, £500. Objects: To carry on the business of factors and manufacturers of and dealers in wireless and television sets, public speech and music amplifying equipment and talking picture apparatus, &c. The directors are: P. T. Danby and Mrs. E. G. Danby, both of 230, Upper Brook Street, Chorlton-on-Medlock, Manchester. Registered office: 230, Upper Brook Street, Chorlton-on-Medlock, Manchester.

Returns of Electrical Companies

English Electric Co., Ltd.—Capital, £5,000,000 in 1,500,000 preference and 3,500,000 ordinary shares of £1. Return dated March 20th, 1936 (filed May 1st, 1936). 1,135,844 preference and 1,443,468 ordinary shares taken up. £902,614 10s. paid on 902,613 ordinary and 1½ preference shares. £1,676,697 10s. considered as paid on 540,855 ordinary and 1,135,842½ preference shares. Mortgages and charges, £1,052,336.

Cox & Co. (R. W.), Ltd.—The nominal capital has been increased by the addition of £5,650 in £1 ordinary shares beyond the registered capital of £6,000.

Standard Switchgear, Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £5,000. The additional capital is divided into 3,500 ordinary and 1,500 5½ per cent. cumulative preference shares of £1 each.

Heala, Ltd.—The nominal capital has been increased by the addition of £9,900 beyond the registered capital of £100. The additional capital is divided into 18,000 ordinary shares of 1s. and 9,000 7 per cent. preference shares of £1.

Lancashire Electric Sign Construction Co., Ltd.—W. K. Blomsley, of The Nook, Litherland Road, Sale, ceased to act as receiver and manager on August 12th, 1936.

B. & F. Carter & Co., Ltd.—Charge on land, buildings, &c., in Bolton, dated August 11th, 1936, to secure £2,727. Holders: Dobson & Barlow, Ltd., Bradley Fold, Bolton.

Eastnor Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated April 6th, 1936. 300 shares taken up. £300 paid. Mortgages and charges, £550.

Electric Agencies, Ltd.—Capital, £2,000 in £1 shares. Return dated July 5th, 1935 (filed May 26th, 1936). All shares taken up. £2,000 paid. Mortgages and charges, nil.

Summit Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1935 (filed April 1st, 1936). All shares taken up. £100 paid. Mortgages and charges, nil.

Wolverhampton Radio Installation Co., Ltd.—Capital, £1,000 in £1 shares. Return dated April 8th, 1935 (filed June 2nd, 1936.) 750 shares taken up. £750 paid. Mortgages and charges, nil.

Whitecroft Instrument Co., Ltd.—Capital, £1,000 in £1 shares. Return dated April 26th, 1936. 150 shares taken up. £100 paid. £50 considered as paid. Mortgages and charges, nil.

Universal Electric Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated August 10th, 1936, to secure £5,000. Holder: L. Gottlieb, 36, Park Road, Crumpsall.

W. M. Betts, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated August 13th, 1936, to secure £600. Holders: Trade and General Development Trust, Ltd., Exchange House, Old Change, E.C.4.

Barratt & Co. (Blackburn), Ltd.—Richard C. Baldwin, of 20, Fox Street, Preston, Lancs, was appointed receiver and manager on August 14th, 1936, under powers contained in debenture dated May 23rd, 1936.

Electric Cushions, Ltd.—G. H. Warmington, of 73, Basinghall Street, E.C., ceased to act as receiver and manager on August 14th, 1936.

British Television Supplies, Ltd.—Capital, £500 in £1 shares. Return dated August 15th, 1935 (filed May 18th, 1936). 55 shares taken up. £55 paid. Mortgage and charges, nil.

County Wireless Services, Ltd.—Capital, £500 in 400 preference and 100 ordinary shares of £1. Return dated September 26th, 1935 (filed April 16th, 1936). All shares taken up. £470 paid on 400 preference and 70 ordinary shares. £30 considered as paid on 30 ordinary shares. Mortgages and charges, nil.

Monks & Byrne, Ltd.—Capital, £2,500 in £1 shares. Return dated December 27th, 1935 (filed August 4th, 1936). 2,000 shares taken up. £1,350 paid. £650 considered as paid Mortgages and charges, nil.

City Notes

Laurence, Scott & Electromotors, Ltd.—An extraordinary meeting will be held on September 9th at which resolutions will be submitted providing that each of the 30,000 ordinary shares shall be sub-divided into four shares of 5s., and that the 120,000 shares resulting shall be converted into "A" ordinary shares, conferring on the holders the same rights and privileges as the ordinary shares, except that the holders will only be entitled on a poll to one vote for every forty "A" ordinary shares held. It is also proposed to increase the capital to £460,995, by the creation of 100,000 5 per cent. cumulative redeemable preference shares of £1 each and 200,000 "A" ordinary shares of 5s. each (ranking *pari passu* in all respects with and subject to the same restrictions as the 120,000 "A" ordinary shares resulting from the conversion). The preference shares will be entitled to a cumulative dividend of 5 per cent., and to priority for capital repayment and arrears of dividend without further participation. The company will on or before May 1st, 1939, and in every subsequent year provide sufficient funds to redeem 3,000 preference shares and may if it thinks fit set aside an additional sum sufficient to redeem not more than 7,000 shares. The sum set aside may be applied in the purchase either by tender or private contract or in the market at or below 22s. per share of preference shares, any partial redemption to be effected by drawings. Any preference shares not previously redeemed will be repaid on December 31st, 2000.

Ismay Industries, Ltd., which was formed in April last year to acquire the ordinary capital of John Ismay & Sons, Ltd., announces a net profit for the initial period to June 30th last of £51,864. Although the period covered by the first accounts commenced on April 11th, 1935, the dividends received from the subsidiary companies represent the earnings of those companies for a period of approximately one year only. Income-tax requires £7,919 and preference dividends £6,573. An interim ordinary dividend of 4 per cent. has already been paid, and it is proposed to make a final distribution of 6 per cent., less tax, leaving a balance of £1,350 to be carried forward. A sum of £50,000 is to be transferred from the general reserve to a special reserve for the equalisation of preference dividends. Meeting: September 3rd.

Tube Investments, Ltd.—In connection with the company's offer to shareholders of one ordinary £1 share at 30s. in respect of every £5 of ordinary stock held at July 29th, Mr. A. Chamberlain (chairman), in a circular to ordinary stockholders, explains the reasons for the issue. Among these is the steady improvement in trade over the last three years, which has called for ever-increasing production from all the factories. As their productive capacity has gradually been taken up and then enlarged, so capital expenditure on additions designed to increase existing output, or to make articles not manufactured by the group, has tended and still tends to grow. Up to the present the directors have spent, authorised, or realised the necessity for authorising an expenditure of upwards of £1,250,000 to make provision for this growth of trade. It would be possible to meet the whole of this expenditure from existing liquid resources, but in view of the permanent character of its expected earning power the directors did not choose to employ so large an amount of the reserves for this purpose. They have accordingly decided to finance the bulk of it by the issue of shares.

The North-Eastern Electric Supply Co., Ltd., has declared an interim dividend of 2½ per cent. on the ordinary stock (unchanged).

Stocks and Shares

TUESDAY EVENING.

NOTICEABLE activity continues to characterise certain sections of the markets which deal in the stocks and shares of electrical issues. For some reason, difficult to explain, the Spanish revolution affects the nerves of the New York stock markets to a greater extent than it influences those on this side of the Atlantic. The Americans are very apprehensive regarding the position in Spain, and throughout Europe as a whole. Our own people maintain, by theory and by practice, that foreign disturbances have the direct effect of driving money into British stocks and shares. Absorption of good-class industrials goes on without ceasing, neither the holidays nor the heat having more than a partial influence. The fixed trusts are insatiable buyers, and, as already men-

tioned here, some of the big insurance and other financial companies are taking whatever lines of shares come to market on the assumption that it is in the ordinary shares that the best prospect of capital appreciation lies. The gilt-edged stocks, in the meantime, keep very steady. There is hardly a move in prices from one week to another.

Electricity Supply Shares

North Metropolitan Electric ordinary shares, at 57s., are a florin up. This is the principal rise in the supply group, but the quotation of some of the other shares ex dividend has resulted in the prices being left unchanged, which means, for practical purposes, that the deductions have already been recovered. This applies to Bournemouth and Poole, City of London, Richmond, at 36s. 6d., and Clyde Valley shares. For the Scottish companies' shares there is a daily demand from the North. It will be noticed that Clyde Valley, on the basis of the last-paid dividend, yield £3 11s. per cent., while Scottish Power, at 42s. 6d., give 3¾ per cent.

Cable and Wireless

Satisfaction, but no material change in prices, of Cable and Wireless stocks followed publication of the July index figure. This was 70.3 per cent., the highest in any July since 1929, and 3.6 per cent. better than the July index of 1935. Study of the returns for each of the past sixty-seven months leads to the conclusion that the combine is gradually making headway, but that there is still plenty of room for improvement. The preference stock, at 102, cannot yet be absolved from its speculative character, nor is the " B " ordinary stock much better than a gambling counter at its present price of 6½. When dealings started, eight years ago, in Cable and Wireless this same " B " stock touched three figures on heavy American buying of what was then regarded as a " healthy equity."

American Conditions

Reference has been made already to the uneasiness which the Spanish position is causing in the minds of American operators. Apparently the fear is that, in the chaos which revolution creates, rates of exchange may become little better than nominal. Moreover, the chance of the revolutionary spirit spreading into neighbouring countries seems to be regarded more seriously in New York than it is in London. Prices of American stocks and shares are susceptible to peculiarly sharp fluctuations owing to the feverish manner in which American speculation operates. A circle of British speculators is following American shares pretty closely just now; but, outside this circle, the interest of the man in the street in American stocks and shares is comparatively small. Brazil Tractions, amongst the dollar stocks, have gone back to 11¼. American Telephone and Telegraph shares are unchanged at 172½.

Anglo-Portuguese Telephone shares, which were standing not long ago at a little over 30s., have receded to 26s. by reason of the Spanish revolution.

Television

This week's opening of Radiolympia has a particular interest for speculative investment in that it may help to illuminate some of the obscurity that hangs over television. At what point of development the baby science has arrived nobody seems to be quite sure. This has stimulated public interest in the shares of Electric and Musical Industries, as these paragraphs have recorded in recent weeks. The price has come up substantially from the lowest reached a few months ago. Various estimates of dividend and profit statements are canvassed. The general impression now is that the company will pay 10 per cent., as against 12½ per cent. a year ago, and will present very good figures in the forthcoming report. The price of the 10s. shares is 24s. 3d. Baird deferred shares are 9s. 6d. and the 20 per cent. non-cumulative preferred ordinary 4s. 6d., both classes being of the denomination of half a crown.

Palestine and Japan

Palestine " A " shares are quoted 45s. 3d. ex the dividend, which leaves the shares a little higher on the week. Tokyo 6 per cent. bonds, at 81½, have recovered a further 5s. Reference was made here last week to the statement as to rejection of the proposal that the Japanese Government should take over control of the electric power industry in Japan. Since then a new national policy has been promulgated for Japan, amongst its plans being one for the establishment of State control of the electric power industry. The programme of which this forms a part is, however, of such wide and ambitious character as to render its practical application a matter of several years.

Miscellaneous Matters

Johnson and Phillips are a good market with a rise to 52s. 6d. Associated Electrical Industries have hardened to 55s., and Ever-Ready shares to 27s. 6d. English Electrics came on offer after their rapid advance. Preference and ordinary lost a few pence on profit-taking sales. Telephone Manufacturing shares are better at 11s. 7½d. Hall Telephone Accessories, at 23s. 6d., have also improved. A halt in the iron and steel companies' advance is reflected in Babcock and Wilcox, which, at 50s. 9d., are ⅛ lower. No change of consequence is to be seen in the quietude that has prevailed for some time past in the rubber share market.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price. Aug. 25.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	77/6xd.	+1/-	3 17 5
City of London	1	7½	7½	37/-xd.	+6d.	4 1 1
Clyde Valley	1	7	8	45/6xd.	+1/-	3 16 1
County of London...	1	10½	10½	54/6	—	3 17 2
Edmundson's 7% Pref.	1	7	7	35/6	—	3 19 0
Do. Ord.	1	8	8	45/-	—	3 11 0
Elec. Dis. Yorkshire	1	9	9	47/-	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3½	—	3 11 5
Elec. Supply Corporation ...	1	11	11	60/9	—	3 12 4
Lancs Light and Power	1	7½	7½	38/-	—	3 19 0
Lond. Assoc. Electric	1	—	7	35/-	—	4 0 0
London Electric	1	7	8	39/6	—	4 1 1
London Power Deb. Red. ...	Stock	5	5	107½xd.	+1	4 13 0
Metropolitan	1	10	10	51/-	—	3 18 5
Midland Counties	1	7	7½	40/6	+6d.	3 14 0
Mid. Elec. Power	1	8	8	45/-	—	3 11 1
North Eastern Electric Ordinary	1	6	6	36/-	—	3 6 8
Do. 7% Pref.	1	7	7	36/6	+6d.	3 16 9
Northampton	1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 3
North Met. Elec. Ordinary ...	1	10	10	57/-	+2/-	3 10 3
Do. do. 6% Pref. ...	1	6	6	32/6	—	3 13 10
Scottish Power	1	8	8	42/6	—	3 15 5
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/6	—6d.	6 19 4
Yorkshire Elec.	1	8	8	44/-	—	3 12 9
Public Boards.						
Central Electricity, 1950–70 ...	Stock	5	5	116½	—	4 5 9
Do. 1955–75 ...	,,	5	5	120	—	4 3 4
Do. 1951–73 ...	,,	4½	4½	111	—	4 1 1
Do. 1963–93 ...	,,	—	3½	104	—	3 7 4
London Elec. Trans. Gtd. ...	,,	—	2½	96	—	2 12 1
London & Home Counties, 1955–75		4½	4½	114	—	3 19 0
London Passenger Transport, A...	,,	—	4½	122½	—	3 13 6
Do. do. B...	,,	—	5	128½	—	3 17 10
Do. do. C...	,,	3½	4	105	—	3 16 2
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10
Telegraph and Telephone.						
American Tel. & Tel.	$100	9	9	172½	—	5 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	127½	—	4 14 1
Do. Def.	,,	1½	1½	32	—	4 13 9
Cable & Wireless 5½% Pref. ...	,,	4½	5½	102	—	5 7 10
Do. A. 7½% Ord.	,,	Nil	Nil	22	—½	—
Do. B. Ord.	,,	Nil	Nil	6½	—	—
Globe Tel. & Tel. Ord. ...	10	3½*	4½*	14½	—	3 3 1
Do. Do. Pref. ...	10	6	6	14½	—	4 3 6
Great Northern Tel.	10	20	20	46	—	4 7 6
Marconi-Marine	1	10	7½	33/9	—	4 9 0
Oriental Telephone Ord.	1	12*	12*	3½	—	3 13 10
Home and Foreign Trams, etc.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1450	—	—
Do. do. Pref. Ord.	,,	8	8	175½	—	4 11 2
Brazil Traction	100	—	30 cts	11½	—½	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	102½	—	4 17 7
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	45	—	—
Victoria Falls Ord.	1	20	12	3⅞	—⅛	3 1 10
West Riding	1	5	6½	50/-	—	2 12 9
Manufacturing Companies.						
Aron Electricity Ord.	1	10	15	65/-	—	4 12 4
Assoc. Elec. Ord.	1	6	8	55/-	+1/-	2 18 2
Do. Pref.	1	8	8	40/-	—	4 0 0
Babcock & Wilcox	1	8	8	50/9	—⅛	3 3 0
British Aluminium Ord.	1	7½	7½	41/6	+6d.	3 12 2
British Insulated Ord.	1	15	20	5½	—	3 11 0
Brush Ord....	Stock	Nil	Nil	41	—	—
Callender's	1	15	15	4½	—	3 6 7
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord. ...	5/-	—	12½	4½	—	—
Do. 8% Pref.	1	8	8	2	+⅛	4 0 0
Edison Swan 1st Pref.	1	7½	7½	30/-	—	5 0 0
Electric Construction	1	3½	7	40/-	—	3 10 0
Enfield Cable Ord.	1	25	25	5½	—	4 9 0
English Electric	1	Nil	Nil	26/6	—6d.	—
Do. Do. Pref.	1	Nil	Nil	27/6	—6d.	—
Ericsson Tel.	5/-	24	20*	2½	—	1 16 1
Ever Ready	5/-	35	35	27/6	+⅛	6 7 3
Ferranti Pref.	1	7	7	28/9	—	4 17 5
G.E.C. Pref.	1	6½	6½	35/-	—	3 14 4
Do. Ord.	1	10	15	86/-	—	3 9 7
Henleys	1	30	30	7½	—	3 15 9
Do. 4½% Pref.	5	4½	4½	5½	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	52/6	+⅛	3 16 2
Lancashire Dynamo	1	5	10	2½	—	3 9 7
Siemens Ord.	1	4	6	32/6	—	3 13 10
Telegraph Construction ...	£1	Nil	Nil	33/9	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1934

6342. "Electric motors." British Thomson-Houston Co., Ltd., and A. H. Maggs. January 29th, 1935. (451099.)
30273. "Electric resistance heaters." R. C. K. Young. October 22nd, 1934. (450959.)
33381. "Electron-discharge tubes." Radio Akt.-Ges. D. S. Loewe. November 27th, 1933. (Addition to 443364.) (450962.)
36972. "Radio receiving systems and the like." Coutts & Co. and F. Johnson (legal representatives of J. Y. Johnson, deceased). (Philadelphia Storage Battery Co.) December 24th, 1934. (Cognate application 1943/35.) (450965.)

1935

216. "Ultra-short-wave oscillation generators." L. H. Paddle. January 3rd, 1935. (450967.)
2504. "Electric fusible cut-outs." A. Reyrolle & Co., Ltd., F. Coates and F. H. Groom. January 25th, 1935. (450970.)
2509. "Electric-discharge devices." British Thomson-Houston Co., Ltd., and H. De B. Knight. January 25th, 1935. (450971.)
2529. "Cathode-ray tubes." Fernseh Akt.-Ges. January 26th, 1934. (450973.)
2533. "Ringers adapted for use in telephone sets." Standard Telephones & Cables, Ltd., J. S. P. Robertson and B. B. Grace. January 25th, 1935. (450974.)
2574. "Navigation-aiding wireless systems for use in connection with aircraft." Marconi's Wireless Telegraph Co., Ltd., and R. J. Kemp. January 25th, 1935. (450975.)
2576. "Electric-discharge device modulator arrangements for use at very high frequencies." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. January 25th, 1935. (450976.)
2626. "Electrodeposition of metals." A. R. Powell, E. C. Davies and Johnson, Matthey & Co., Ltd. January 26th, 1935. (450979.)
2956. "Electrical time base arrangements for use in oscillographic observations and the like." A. C. Cossor, Ltd., and L. H. Bedford. (January 29th, 1935. (451117.)
2989. "Loudspeakers." G. Birkbeck. January 29th, 1935. (451173.)
3099. "Wireless and like receivers, and tuning control apparatus for use therewith." A. H. Cooper. January 30th, 1935. (451223.)
3163. "Electric circuits embodying an electric motor and an electric lamp." Hoover, Ltd. (Hoover Co.). January 31st, 1935. (451226.)
3167. "High-frequency and like carrier signalling systems." General Electric Co., Ltd., N. R. Bligh and C. N. Smyth. January 31st, 1935. (451227.)
3193. "Feeding mechanism for arc lamps with rotating carbons." Korting & Mathiesen Akt.-Ges. February 1st, 1934. (451258.)
3222. "Electrical signalling, indicating and telephoning system, and apparatus therefor." J. Stepham and H. E. Stiles. January 31st, 1935. (451230.)
3306. "Electromagnetic carbon-pile regulators." J. Stone & Co., Ltd., and G. P. Ogilvie. February 1st, 1935. (451232.)
3324. "Gas-blast electric switches." British Thomson-Houston Co., Ltd. February 1st, 1934. (451233.)
3326. "Lanterns for electric lamps." British Thomson-Houston Co., Ltd., E. B. Tuppen and C. W. Wood. February 1st, 1935. (451234.)
3391. "Carrier-wave transmitting apparatus." Standard Telephones & Cables, Ltd., C. E. Strong and F. C. McLean. February 1st, 1935. (451237.)
3392. "Thermionic valve amplifiers." Standard Telephones & Cables, Ltd., and E. K. Sandeman. February 1st, 1935. (451238.)
3393. "Electric cables." Standard Telephones & Cables, Ltd., and R. C. Milner. February 1st, 1935. (451239.)
3429. "Method of and apparatus for producing multiple electric spot welds simultaneously or in sequence." W. Meacher. February 2nd, 1935. (451037.)
3591. "Manufacture of stems for electric incandescent lamps." A. Hofmann & Co. November 24th, 1934. (451039.)
4281. "Wireless reception of television transmissions which are synchronised by signals differentiated by amplitude." Radio Akt.-Ges. D. S. Loewe. February 12th, 1934. (451042.)
4600. "Electric vibratory massage apparatus." Electric Supplies & Repairs, Ltd., and H. Hibbert. February 13th, 1935. (451043.)
6737. "Electrically heated hotplates." General Electric Co., Ltd., and G. H. Ide. March 4th, 1935. (451052.)
7339. "Thermionic and like time-base circuits." General Electric Co., Ltd., and D. C. Espley. March 8th, 1935. (450986.)
7567. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., and H. W. W. Walden. March 11th, 1935. (451056.)
9022. "Apparatus for electrically heating bars and other members." H. Wilkinson. March 22nd, 1935. (450988.)
9705. "Electric conductors." W. T. Henley's Telegraph Works Co., Ltd., and H. J. Hodges. March 28th, 1935. (451060.)
9760. "Control of lifting electromagnets." W. E. Burnand. March 29th, 1935. (450990.)
11068. "Dynamos for use in electric lighting sets for pedal and other cycles." M. Miller. April 10th, 1935. (451126.)
11094. "Electric water heaters." Ferranti, Ltd., and J. H. Watkiss. April 10th, 1935. (450991.)
12490. "Television apparatus." Scophony, Ltd., and G. W. Walton. April 25th, 1935. (451132.)
12869. "Emergency braking means for electric winders." General Electric Co., Ltd., and H. J. Coates. April 30th, 1935. (451133.)
13680. "Snap-action electric switches." Foster Engineering Co., Ltd., and E. Dobson. May 9th, 1935. (451135.)
13876. "Electric thermostats." General Electric Co., Ltd., and E. P. L. Westell. May 31st, 1935. (451141.)
16061. "Electrical systems for registering and counting votes." Reliance Telephone Co., Ltd., and W. T. Ashton. June 4th, 1935. (451143.)
16787. "Electrolytic etching machines." British Insulated Cables, Ltd., S. D. Syndicate, Ltd., E. G. Hartel, F. J. Brislee and R. Blackburn. June 11th, 1935. (451001.)
19314. "Magnetron tubes and arrangements incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. July 5th, 1934. (451149.)
21259. "Snap-action mechanism for operating electric switches, valves and other devices." T. G. Richmond and R. MacLaren & Co., Ltd. July 26th, 1935. (Cognate applications 21704/35 and 21936/35.) (451005.)
22012. "Reflecting oscillographs." British Acoustic Films, Ltd. (P. F. Beer). August 2nd, 1935. (451155.)
23049. "Electrically operated turning lathes." W. W. Triggs (Pratt & Whitney Co.). August 16th, 1935. (451157.)
25175. "Electrical conversion systems." Westinghouse Electric & Manufacturing Co. October 11th, 1934. (451160.)
27942. "Coin-freed mechanism more especially designed for use with electricity meters." Landis & Gyr Akt.-Ges. October 17th, 1934. (451165.)
30926. "Radio direction-finding systems." Standard Telephones & Cables, Ltd. November 20th, 1934. (451019.)
32763. "Electric cables and electric cable systems." Okonite-Callender Cable Co., Inc. November 27th, 1934. (451195.)
33745. "Direct-current ampere-hour meters for use in remote measurement." Landis & Gyr Akt.-Ges. December 15th, 1934. (451076.)
34077. "Rotary liquid electric rectifiers." Siemens Schuckertwerke Akt.-Ges. December 7th, 1934. (Cognate application 34078/35.) (451079.)
35133. "Electrode feeding apparatus." British Thomson-Houston Co., Ltd. December 18th, 1934. (451198.)
35518. "Device for the electric heating of rooms." E. Runte. December 21st, 1934. (451200.)

1936

303. "Antenna structures." C. Lorenz Akt.-Ges. January 12th. 1935. (Cognate application 304/36.) (451201.)
1026. "Arrangement for generating a saw-tooth voltage." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 12th, 1935. (451204.)
1612. "Electroplating or electro-deposition processes." Fescol, Ltd., and R. E. Wilson. January 17th, 1936. (451088.)
4434. "Low frequency thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 15th, 1935. (451207.)
5745. "Electric starting installations for internal-combustion engines." Scintilla, Ltd. February 26th, 1935. (451212.)
6436. "Wireless aerials." R. Jensen. March 4th, 1935. (451213.)
7658. "Electrodes." H. Seabrook (Ges. zur Verwertung Chemisch-Technischer Verfahren Akt.-Ges.). March 13th, 1936. (451215.)
7665. "Electric transformers." British Thomson-Houston Co., Ltd. March 27th, 1935. (451216.)
8924. "Apparatus for the measurement of self-inductance." A. Campbell. March 25th, 1936. (451094.)
14731. "Amplifier circuits." Radio Akt.-Ges. D. S. Loewe. November 27th, 1933. (Divided out of 450962.) (451021.)
16654. "Apparatus comprising a low permeability core with an inductive winding thereon." L. L. De Kramolin. October 23rd, 1933. (Divided out of 449240.) (Cognate application 16655/36.) (451097.)
16656. "Method of regulating radio apparatus." L. L. De Kramolin. October 23rd, 1933. (Divided out of 449240.) (Cognate application 16657/36.) (451098.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 19th.

L.G.; Kandem Motors (lettering and design). No. 567209. Class 6. Motors, dynamos, motor generators, convertors and transformers.—Kandem Motors, Ltd., 769, Fulham Road, S.W.6.

Berec (lettering and design). No. 569887. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7.

Argenta. No. 566557. Class 13. Electric incandescent lamps (ordinary).—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Intmica. No. 568215. Class 50. Electrical insulating substances of mica.—Interohm Electrical Insulators, Ltd., 31-34, Grosvenor Place, Westminster, S.W.1.

Electricity in Mines

The reports of the Secretary for Mines and the Chief Inspector of Mines for 1935, have now been published in one volume (Stationery Office, 3s. 6d.). The first contains a general review of the coal and other mining and quarrying industries, including an account of the working of the Coal Mines Act, 1930. Other sections deal with fuel treatment and utilisation, with particular reference to the production of oil products from coal, the use of pulverised fuel, low-temperature carbonisation and hydrogenation, administrative matters affecting health and safety and the work carried out at the official testing stations.

The report of the Chief Inspector reviews the mining accidents which occurred during the year and discusses generally the progress made in preventive measures, and the lines along which it can be made. The volume includes a comprehensive statistical appendix with charts dealing with all the main aspects of the mining and quarrying industries. Other appendices furnish lists of the principal official publications relating to these industries and of the official committees.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Swimming baths, £70,000 (sun-ray treatment); city engineer.

Ashby-de-la-Zouch.—Houses (72); J. O. Cook, R.D.C. surveyor.

Barking.—Factory, for E. J. Elgood, Ltd., Yeoman Street, London, S.E.8.

Birkenhead.—Houses (74), Greenbank estate, Upton; W. M. & M. W. Shennan. Houses (52), Woodcote estate, Old Chester Road; Brown & Saunders. Employment exchange, adjoining Bebington Road.

Birmingham.—Cinema and shops, Walsall Road, Great Barr, with electrical work; R. Satchwell, architect, 6, New Street, Birmingham. Block of shops, Stratford Road; R. H. Davis, builder, Shirley.

Blyth.—Junior instruction centre; Gibson Bros., Hill Heads, Whitley Bay.

Bognor.—School, West Loats Lane (£55,991); Chapman, Lowry & Puttick.

Bournemouth.—Factory and offices, Ringwood Road; British Incorrodible Metal Co., Ltd. Shops, flats, theatre, &c., Christchurch Road; Elcock & Co. Houses (32), Weymans Avenue; T. C. Butler.

Bristol.—Rebuilding Metropole Cinema, Ashley Road (£40,000); architect, 1, Clare Street. Cinema, Bedminster, with air-conditioning plant and electric organ, for Union Cinemas; Verity and Beverley, architects, 32, Old Burlington Street, London, W.1.

Brynmawr.—Houses (73); U.D.C. surveyor.

Cheshire.—Hospital extensions, Clatterbridge; county architect, Chester.

Chigwell (Essex).—Church and schools, Loughton Way, for the Methodist trustees; secretary.

Clacton-on-Sea.—Cinema, for the Exclusive Theatre Co.; H. McQuillen, Main Road, Holland-on-Sea.

Cookham (Berks).—Houses (18); J. H. Joyne, R.D.C. surveyor, 3, Park Street, Maidenhead.

Coventry.—Houses (170), Radford Aerodrome site; E. H. Ford, city engineer.

Dagenham.—Cinema, tearoom and showroom; manager, Ford Motor Works.

Darlington.—Houses, near Carmel Road; J. Parvin & Sons, builders, 17, Horsemarket.

Dundee.—Four-storey building (central heating) for A. G. Kidd, Ltd., Overgate; the manager.

Durham.—Extensions to Wraith secondary school, Spennymoor (£26,790). Nurses' homes, Durham, Easington, Lanchester and Chester-le-Street. All county architect, Durham.

Edinburgh.—Buildings for MacDonald & Muir, Ltd., Queen's Dock.

Folkestone.—Premises for Bobby & Co., Ltd., Sandgate Road; G. Baines & Son, architects, 121, Victoria Street, London, S.W.1.

Glasgow.—Church, Hartlaw Crescent, Cardonald; Church of Scotland trustees. Factory; J. Templeton & Co., carpet manufacturers, Glasgow, S.E.

Glossop.—Buildings at Hawley's Corner, 1-3, High Street West; Montague Burton Estates, Ltd., Hudson Road Mills, Leeds, 9.

Hamilton.—Central premises, shops and offices (£19,200), Gateside Street, for the Central Co-operative Society; secretary.

Hanley.—Factory extension, Nelson Road; Johnson Bros. (Hanley), Ltd.

Huddersfield.—Extensions, F. W. Taylor & Son, Albion Works, Milnsbridge. Electricity showrooms and shops, Market Street, for the T.C.; Estate Manager, Railway Street.

Irish Free State.—(Dublin).—Flats, Poplar Row Housing Area; H. G. Simms, housing architect, 3, Parliament Street, Dublin. (Westport, Co. Mayo).—Boot factory; P. J. Donnelly.

Kent.—Gymnasium and library, Chatham; county architect, Maidstone.

Kettering.—Factory, for Greenlees & Sons (Easiephit Footwear), Ltd., Leicester.

Kidderminster.—Additions to works, Mount Pleasant, for Tompkinsons, Ltd., Carpet Manufacturers, Church Street; Gething & Rolley, architects, Kingsley Hall, Vicar Street. Additions to works, New Road, for the Carpet Manufacturing Co.; Pritchard, Godwin & Clist, architects, Market Chambers, Exchange Street.

Kilmarnock.—Cinema, King Street (£70,000); T. Shankland, architect, Glasgow.

Lancashire.—Grammar school extensions, Bacup (£15,801), for the County E.C.; S. Wilkinson, county architect, Preston.

Langley Park (Co. Durham).—Cinema; W. Dunn, Dunning Road, Ferryhill.

Leicester.—Factory; Burgess Products Co., Ltd.

Lincoln.—Theatre (£60,000); British Playhouses and Film Studios Parent Co., Ltd.

Littlehampton.—Houses, Parkside estate; F. Hamlet.

Liverpool.—Cinema (1,780 seats); A. E. Shennan, architect, North House, 17, North John Street. Cinema, for Bedford Cinemas (1928), Ltd., 19, Castle Street; Tysons (Contractors), Ltd., Dryden Street.

Liversedge (Yorks).—Laboratory, Woodfield Mill, for Birkby's, Ltd., electrical engineers; J. Crossland & Sons, Ltd., 42, New Lane, Cleckheaton.

London.—(Fulham).—Stores, North End Road, for British Homes Stores, Ltd.; A. L. Farman, architect, Abbey House, Baker Street, London, N.W.

Longbenton (Northumberland).—Houses (44), Seaton Burn; W. Bean, U.D.C. surveyor, Council Offices, Forest Hall.

Luton.—Factory; Alcock (Peroxide), Ltd.

Lymington.—Senior school (400 places), New Milton, for T.C.

Manchester.—Houses (38), Chandos Grove, Pendleton, with electrical work; C. F. Napper, builder, 91, Station Parade, Harrogate. R.C. school (£10,000); Moston Brick & Building Co., Ltd., builders, Kenyon Lane, Moston.

Margate.—Municipal offices and police headquarters; borough surveyor.

Melksham.—Extensions, Wilts United Dairy Co., Ltd.; Bovis, Ltd.

Mytholmroyd (Yorks).—Housing estate, Nest Lane; U.D.C. surveyor.

Newcastle (Staffs).—Schools, Silverdale Road (£25,900), for the Roman Catholic managers; priest-in-charge.

Northenden.—Factory, for Keates, Brown & Co., Ardwick.

Oldham.—Houses (100); borough surveyor.

Oxford.—R.C. Church, Wharfton Road, Headington; G. T. Gardner, architect, Franciscan Friary, Iffley Road.

Penistone (Yorkshire).—Houses (40); Pennington, Hustler & Taylor, architects, Ropergate, Pontefract.

Radnorshire.—School, Knighton, for the county E.C.; director of education, Llandrindod Wells.

Rochester.—Extensions to Girls' Grammar School; governors.

St. Helens (Lancs).—Houses (178), Parr, for M. Jaffe, Parkfield Road, Lark Lane, Liverpool.

Salford.—Extensions to works of Salford Electrical Instruments, Ltd., Silk Street; Moston Brick & Building Co., Ltd., Kenyon Lane, Moston. Departmental stores, Regent Road, for British Home Stores, Ltd., 221/3, Baker Street, London, N.W.1; D. Walton & Co., Ltd., builders, Clarendon Road, Pendleton. Cinema, Cross Lane, for Carlton Cinema (Salford), Ltd., 1, Princess Street, Manchester; J. E. Armstrong, Ltd., contractors, Yew Street, Lower Broughton, Manchester.

Sevenoaks.—Buildings, Walthamstow Hall School, Knowle Park; governors.

Slough.—Aerodrome, for the U.D.C. Houses (454), Upton Lea estate; Manor Park Construction, Ltd. Hotel, Taplow; Courage & Co., Ltd., Horselydown, London, S.E.

Solihull.—Estate development, Widney Road; Crabbe Bros., 55, Newhall Street, Birmingham.

Southend-on-Sea.—Milk distribution depôt with plant, Folly Farm, for Howard's Dairies, Ltd.; P. G. Hayward, Ltd.

Sowerby Bridge.—Extensions; H. Broadbent, Ltd.

Stockton-on-Tees.—New weights and measures offices for the T.C.; borough surveyor. Houses (5½ acres) site near Oxbridge Avenue; G. Hope, builder, "Montrose," Hartburn Avenue.

Stourbridge.—Council chamber and offices, with electrical work; F. Woodward, borough surveyor, Council House, Mary Stevens Park.

Stratford-on-Avon.—Estate development, Main Road; J. Booker.

Sunderland.—Houses (492), Hylton Lane estate, for the North-Eastern Housing Association, Newcastle; J. E. Lewis, borough engineer, Town Hall. Alterations and additions in Hinds Place, for Walker Brothers & Co.; F. L. Carrell, architect, 32, Blandford Street. Highways depôt, Newcastle Road, for the T.C. (£4,000); borough engineer. School, Ford estate, for E.C.

Surrey.—Central school, Caterham.

Sutton Coldfield.—Buildings, The Parade, for Montague Burton, Ltd., Hudson Road Mills, Leeds, 9; W. & A. Forsdike, Ltd., builders, St. Mary's Road, Sheffield, 2.

Taplow (Bucks).—Flats (30), River Road and Ellington Road; J. Bond.

Todmorden.—Works extensions, Bacup Road; F. & J. H. Temperley, Ltd.

Tow Law (Co. Durham).—Houses (50); A. Forster, Pease's West, Crook, Co. Durham.

Walsall.—Works, Bentley Lane, for Platt Bros. & Co. (Gilbert Harvey, proprietor), Malleable Iron Founders, Corporation Street; H. E. Lavender & Close, architects, Upper Bridge Street. Houses, near Wolverhampton Road, with electrical work; Hodge Hill Estates, 858, Washwood Road, Ward End, Birmingham. Block of shops and offices fronting on St. Paul's Street (electrical work); J. & F. Wootton, builders, Pinfold, Bloxwich. Factory, corner of Broadway West and Bescot Crescent (electrical work); Smith & Co. (Bidford), Ltd., builders, 205, Corporation Street, Birmingham.

Wantage.—Houses (36); George Green, architect, Town Hall.

Warrington.—Extensions to Bank Quay Mills, with electrical work, for J. Fairclough & Sons, Ltd., corn millers, Mersey Mills, Warrington; H. Fairclough, builder, Howley, Warrington.

Warwick.—Cinema; Bradley and Clarke, 10a, Temple Row, Birmingham.

Washington.—Briquette factory; Washington Coal Co., Ltd.

Wednesbury.—Extension to works, for the British Steel Constructions (Birmingham), Ltd.

Welham Green (Hertfordshire).—Factory, for Imperial Chemical Industries, Ltd., Imperial Chemical House, Millbank, London, S.W.1.

West Drayton.—Factory; Geo. F. Clark & Sons.

West Hartlepool.—Houses, five-acre site, Millbank estate, for the North-Eastern Housing Association: F. Durkin, borough engineer, Town Hall.

West Sussex.—Art school, Horsham, for County E.C., Chichester. Central laundry, Chichester (£23,000); county architect, Chichester.

Wolverhampton.—Factory; Pastori & Casanova (England), Ltd.